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Strategic & Operational Evaluation of the Optocap Project

Scottish Enterprise Edinburgh & Lothian

06/02/2006

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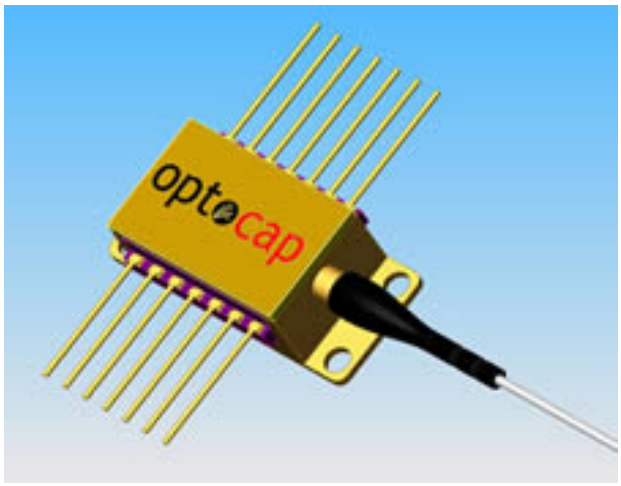


EXECUTIVE SUMMARY

Scientific Generics (SG) has been asked to perform a review of the Optocap Project that satisfies the detailed requirements of the Gate 4 review process and which provides an operational and strategic assessment of Optocap Limited. We have executed a process that combines both external and internal views of Optocap and which then combines and resolves those views in order to reach our conclusions. The purpose of this normal public sector review is to provide an independent expert analysis of the project's performance and future strategy for the optimum delivery of the project's aims and objectives.

Background

The Optocap Project and the associated company Optocap Limited are part of the delivery of the Scottish Executive's *Smart, Successful Scotland* strategy. Accordingly, the initiative is designed to provide a commercialisation route and complete a fully functional supply chain for Scotland's innovations in Optoelectronics. The project implementation started in December 2002 by Scottish Enterprise Edinburgh and Lothian (SEEL).

The overall aim of the project is to establish a centre of excellence in optoelectronic packaging in Scotland with the following functions;

- To provide environmental test, reliability and qualification services
- To assist with the commercialisation of R & D
- To develop new device packaging technologies

In terms of targets it aims to create and deliver 9 Economic Development Projects (EDP) to support the development of Scotland's optoelectronics sector. The purpose of EDP is mainly to support commercialisation of optoelectronic technology emerging from Scottish universities and new start up companies. Additionally, the project has to generate commercial income without compromising the primary EDP objective. The project is also required to undertake the above activities without competing against commercial companies.

During the final stages of the project development the commercial telecom market, at that time the dominant user of packaged optoelectronic components, experienced a major downturn. This market crash may have a short term impact on Optocap Limited but the breadth of its addressable market and the resultant diversifying of the optoelectronics industry suggests that this downturn should not affect its long-run commercial success. The commercial revenues at Optocap Limited appear to be restricted currently by the lack of systematic marketing rather than by lack of commercial opportunities.

In contrast the funding of Scottish universities renowned for excellence in optoelectronic R&D has not fallen and there is also a growth in academic projects in related technology areas such as MEMS, nanotechnology and

biotechnology all of which need prototype packaging capabilities that could be offered by Optocap Ltd.

Inception

The development of the Optocap Project (OP) took place over a 2 year period (Feb 2001-Dec 2002). The process initially followed the existing Scottish Enterprise (SE) procedures and was iterative with changes to the concept, risk analysis, governance, budget and demand being fed back into the assessment, review and planning phases. In assessing the initialisation and approval process the most immediate issue is the 22 months between the start of the process and the final approval. For SE to help the Scottish economy respond to the continually reducing time to market caused by global competition, it clearly needs to examine ways of speeding up its decision making processes. Interestingly it emerged that the majority of the approval process was successfully executed in 8-9 months of 2002 after a formal project plan was created and managed by a newly appointed project manager.

During the approval process a number of the necessary activities were delivered very effectively. These best practices included a detailed technology and market demand research service, an externally facilitated peer review workshop, a serious attempt to purchase the services from the private sector and a rigorous risk register analysis. An area of particular innovation was the decision to change from a delivery model of a company limited by guarantee to one limited by shares. This approach will ease the exit strategy in providing a more straightforward process for SE to sell Optocap Ltd at the end of the project period. In contrast the approvals process also displayed weaknesses in the economic benefits analysis, the lack of a due diligence reality check on the market demand and the need for more rigorous target setting.

Finally, SE took advantage of a rare opportunity, caused by Nortel's sale by auction of its UK packaging facility, to acquire much of the necessary capital equipment for Optocap Ltd. at a fraction of the normal value. This decision reduced the project delivery costs by over £1m through a cost saving of circa 81%. Whilst the financial benefits of this decision are strongly justified there are issues about the appropriateness and risk of investing in a project before it is approved.

The priority recommendations to continue to improve future project approvals are:

- Refine, capture and implement a faster, more efficient project phase gate process.
- Appoint a Director to lead each project concept and to mentor the project leader as he/she manages the project through the phase gate process using a formal project plan.
- Set up authorisation procedures between SE/SEEL Board meetings.
- Use SMART definitions to tighten up target setting for project outcomes.

- Repeat the detailed scoping of demand used in the Optocap project but with inclusion of rigorous third party due diligence assessment.
- Conduct an improved analysis and documentation of market failure and state aid position.
- Include the rigorous exploration of alternative methods of supply.
- Retain the use of an externally facilitated peer review workshop to focus the project and to identify risks.
- Maintain the quality of the Optocap risk register in future projects.
- Improve the assessment of economic benefits.
- Develop improved financial modeling of exit outcomes based on a preferred strategy.
- Make an early choice of ownership model.

Implementation

The implementation process was well planned and delivered effectively with Optocap Ltd incorporated in February 2003, the CEO starting in June 2003, the building leased from July 2003 and the first customer contract in place in October 2003.

In assessing the plans, documents and procedures used during the implementation process, it is clear that the setting up of Optocap Ltd. was performed professionally with a rugged approach to protecting the special rights of Scottish Enterprise as 100% owner of the company. The governance tests applied to the start up process identified some issues for future consideration but most of the tests show that Optocap is compliant and was set up with a professional approach to managing and operating this public sector project.

Given that the long term aim was to add commercial sales to the company revenue and to achieve a sale of the company as the exit strategy there were a few decisions made that in retrospect could be improved. Specifically, the company board membership is set up to reflect SE's ownership, but it does not have a strong commercial/entrepreneurial member to balance the public sector dominance or provide sales and marketing direction. Also, to protect the SE ownership rights the CEO job specification does not offer any directorship, a fact that is a disincentive for high quality business leaders.

The packaging and test facilities at Optocap comprise a wide variety of good quality equipment, enabling the company to offer a broad range services to business and academic projects. However, this equipment is not in a Cleanroom environment; this is a strange decision given the standard use of Class10,000 cleanrooms in most optoelectronic packaging companies.

The priority recommendations to continue to improve future project implementation are:

- Capture the planning and management techniques used in delivering the Optocap start-up.
- For future start-up companies ensure that the CEO has a Director role to increase the job attractiveness for high performance business leaders.
- Ensure that the board structure and membership has a balanced skills / experience level to improve the commercial / entrepreneurial representation.
- Ensure facilities are fully appropriate to market needs (e.g. cleanrooms).

Performance

The general operation of Optocap Limited is assessed as being good with the benefits of a particularly well selected and balanced team. Consultation with stakeholders and customers indicate general satisfaction with the performance of Optocap Limited, for both EDP and commercial projects. The CEO and his top management team (all electronics industry professionals) work together well and are particularly focussed on delivering an adaptive and professional service level to their customers. They also operate a conservative cost model, which is delivering a lower grant spend rate than in the business plan.

At the operations level the business processes are appropriate for its size (13 staff). There are some areas of financial control, staff training and project resource monitoring that do need improvement to reflect the continuing growth of the company.

In terms of delivery against the project targets Optocap Ltd is being affected by the market changes in the sector and the EDP project level at 3 signed contracts (2 more expected in the next 3-6 months) against a target of 9 is behind the business plan targets. In our assessment the EDP contract level is a function of the academic client progress rate and not Optocap's efforts. However, in the commercial market there is real evidence of a need to improve and broaden the company's marketing efforts. Outside the local optoelectronic network there are very few organisations who know of Optocap's existence. The board and CEO are working together to change the company targets to adapt the company's offering to the market changes.

Having successfully gone through the start-up phase and adapting to the market changes it is crucially important that the company now increases its operational efficiency as well as EDP and commercial performance to ensure its sustainability. The priority recommendations to deliver these changes are:

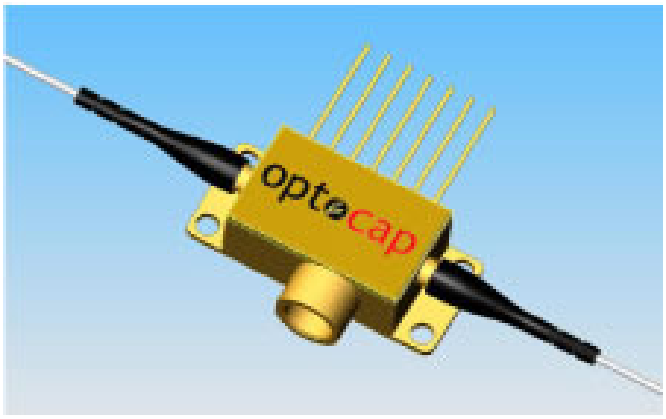
- Greatly increase commercial targets and increase the marketing to meet these needs.
- Broaden marketing to new sectors, (e.g. MNT, MEMS and Biotechnology).
- Change the board structure and membership to improve the commercial / entrepreneurial representation.

- Revise EDP targets to 6 at end of three years to reflect market demand and pipeline.
- Continue to use the dual role of Project Manager and Board member, but reduce operational contact with the CEO.
- Continue to improve financial controls.
- Introduce a time booking system to improve project costing and management.
- Improve staff appraisal & training to deliver continuous performance improvement.
- Ensure facilities are fully appropriate to market needs (cleanrooms).

Exit Strategy

In approving and setting up the Optocap project Scottish Enterprise has a strategic ambition to sell Optocap Limited as a sustainable and commercial asset for the Scottish economy. Ideally, this will remove SE's risks and financial exposure whilst maintaining the Scottish sector supply chain and the availability of an EDP delivery organisation. Our evaluation has shown that the exit strategy options are limited, but to deliver its goals SE should prioritise on actions to improve company value and deliver a viable exit;

- Set significantly higher commercial revenue targets in order to maximize company value ahead of its sale.
- Pursue a trade buyer with immediate effect since trade sale appears to be the only viable exit option.
- Consider higher volume production and its implications.
- Consider testing if the market will stand higher prices for commercial services.



1 PURPOSE OF THE EVALUATION

Scientific Generics has been asked to perform a review of the Optocap Project that satisfies the detailed requirements of a Gate 4 review for the Project and which provides an operational and strategic assessment of Optocap Limited. The basic questions that we set out to answer were:

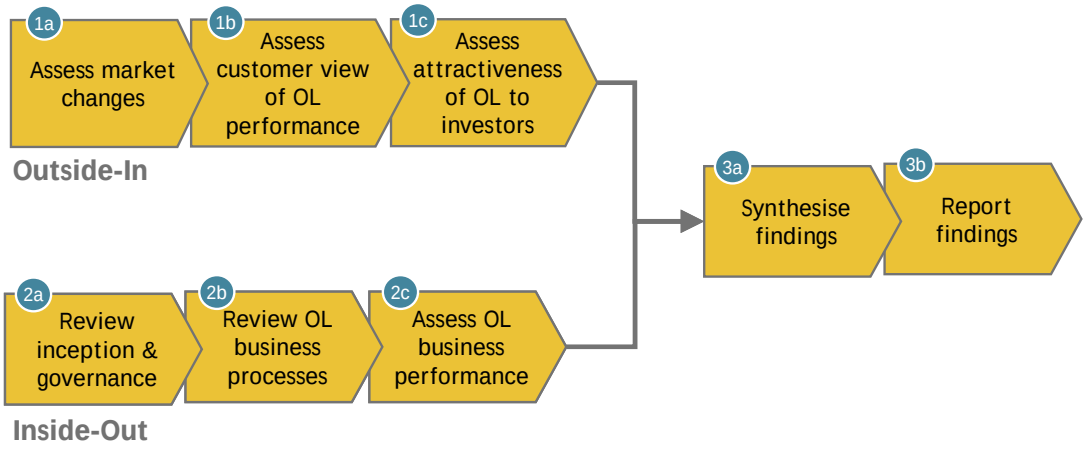
Question 1: What improvements could SE/SEEL make to the approach taken with the Optocap Project when establishing future projects of this kind?

Question 2: How well has Optocap Limited performed in achieving the Optocap Project objectives, taking account of any changes in the market for its services?

Question 3: What should be the future ambitions for the Optocap Project / Optocap Limited and what should be the exit strategy?

In answering these questions we have considered the perspectives of both the private and public sectors. So, for example, in evaluating the dual role of Ian Blewett (as both Optocap Project manager and Director of Optocap Limited) we have been able to compare this with our experience of management control in other public sector projects, and with the controls imposed by venture capital funds on their investee companies in the private sector. We have been able to achieve this by assembling an experienced team with expertise in consulting and senior management in both the public and private sector.

The process that we have followed is summarised in the following figure.



We have executed a process that combines both external and internal views of Optocap and which then combines and resolves those views in order to reach our conclusions. The external view is drawn from desk research and interviews around changes in the market, customer interviews and discussions with venture

capital companies. The internal view is drawn from interviews with those responsible for inception, documents used during the inception process, interviews with the Optocap Limited staff and company documents. For both the external and internal views we have overlaid our own judgement as to what would be regarded as good practice in the public and private sectors.

This report provides our answers to the basic questions above. The three questions are essentially treated in turn in sections 3 to 5 below, following a brief introduction to the background to the Optocap Project in section 2. In these three major sections we address the key issues of concern for operations and strategy. The details of our operational assessment, and particularly the Gate 4 questions, can be found in the Appendix.

2 BACKGROUND TO OPTOCAP PROJECT

The Optocap Project is an economic development activity of Scottish Enterprise (SE), the government's prime agency for economic development in Scotland, which derives its function from the Enterprise and New Towns Act (Scotland) 1990. This project and the associated company Optocap Limited are part of the delivery of the Scottish Executive's *Smart, Successful Scotland* strategy under the **Growing Business** theme. Accordingly, the initiative is designed to provide a commercialisation route and complete a fully functional supply chain for Scotland's innovations in Optoelectronics. The project implementation started in December 2002 for SE by its local enterprise company, Scottish Enterprise Edinburgh and Lothian (SEEL).

The overall aim of the Optocap project is to establish a centre of excellence in Scotland in the field of encapsulation of optoelectronics components. It has three specific sub-objectives[1]:

- To provide environmental test, reliability and qualification services
- To assist with the commercialisation of R & D
- To develop new device packaging technologies

In terms of targets for the above objectives, it aims to create a specified number of 9 projects for the development of the optoelectronics sector in Scotland, (referred to in the rest of this document as Economic Development Projects, or EDP), over an initial 3-year period. Additionally, as resources permit, the project has to generate commercial income without compromising the primary objective. The project is also required to undertake the above activities without competing against commercial companies.

The Optocap Project is being delivered by Optocap Ltd (SC 244596), a wholly-owned profit-making subsidiary of Scottish Enterprise, limited by shares and incorporated on 25 February 2003. The Company's objectives are set out in its Memorandum of Association.

The precise technical focus of the proposed Optocap Project has been relatively fluid, covering at various times the entire spectrum of electronic and optoelectronic packaging, MEMS, displays and biochips. The main area that was eventually eliminated from being targeted was general electronic device packaging, since this was considered to be well provided for in the market, particularly by Far Eastern companies. Even with this restriction, Optocap Limited has considerable freedom to operate across diverse packaging applications and has supported projects to date in the optoelectronic, display, electronics, MEMS, sensor and biochip areas.

The context in Scotland at the time of the launch of the Optocap Project, however, was that a number of optoelectronic start-ups had recently been spun

[1] SEEL Board Paper, December 2002

out of Scottish universities to address the long-haul telecom sector. The fact that equipment was bought by Scottish Enterprise at auction from Nortel, in anticipation of the Optocap Project, reinforces the impression that support for the telecom sector was a major factor being considered.

During the long period of inception of Optocap there was a marked and sustained downturn in the telecom industry globally, and this seriously affected the Scottish start-ups that were unable to change their focus fast enough to survive the downturn. At a global level the industry equipment leader, JDS Uniphase, posted the highest loss ever then recorded by a company of $51 billion in 2001. In Scotland Kymata, Essient and Terahertz Photonics were all closed down by the end of 2003. Intense Photonics managed to re-invent itself as a supplier of laser arrays to the industrial inkjet market rather than to the long-haul telecom market.

In England the pattern was the same[2]. Those companies that could not diversify from telecom suffered, with the optoelectronic components business of both Nortel and Marconi being bought by Bookham in 2002. Southampton Photonics re-focused itself as a fibre laser company, moving away from Bragg gratings for long-haul telecom. Indigo Photonics, which launched only in 2001, had exited telecom and had been acquired by a sensor company by July 2003. As a result of this downturn, the telecom market - which was Optocap's most natural hunting ground for commercial contracts – will undoubtedly have provided significantly fewer opportunities for Optocap Limited than anticipated at the outset of the Optocap Project. Six of the nineteen local organisations specifically targeted for potential commercial revenues during the inception phase of the Optocap Project were telecom companies[3]. Of these, four are now closed.

It might be thought that such a downturn could also present opportunities to Optocap, since the larger optoelectronics companies might look to outsource some packaging operations. Our interviews indicate that high volume production is certainly moving *offshore*, since production in the Far East is now used in order to reduce cost. Packaging by large companies is generally still done *in-house*, however, since packaging lines have modest capital investment requirements. In any case, packaging development is still firmly located within the large companies. The main technical development in packaging for telecom is the move away from pigtailed devices towards pluggable devices.

This is not to say that there has been no positive action around the UK: in Wales, the WDA and the private sector in North Wales have collaborated in the establishment of an Optoelectronics Technology and Incubation Centre (OpTIC) where potential customers for Optocap may be established. OpTIC began operations in June 2004.

[2] More details can be found in Appendix E of the companies mentioned and other start-ups from the period.
[3] Scottish Optoelectronics Packaging Centre, First Draft Discussion Document, July 2002, p53.

In other sectors the situation has not been so adverse:

- The micro display start-ups from the inception period have largely survived, with MED succeeding in an AIM flotation in 2004 and CRLO Displays receiving funding in 2004 to commercialise the CRL Opto / MicroVue technology further.
- According to In-Stat, the MEMS market grew by 32% in 2004 and is predicted to grow at an annual rate of 20% over the next few years; investment in MEMS companies increased 44% in the same year, indicating that packaging opportunities should continue to feed through from commercial companies that might benefit Optocap.
- Global revenues of fabless semiconductor companies grew by 27% in 2004. Although Europe lags considerably behind the USA in this sector, with few European companies in the world's top 50 and only ~5% of the global market, this sector offers some potential for commercial revenues for Optocap for electronic applications.
- According to the Freedonia Group, the biochip market is currently growing at around 20% per year. This market offers opportunities to integrate MEMS devices, light sources, optics and sensors into fully functioning systems and could be a key target market for Optocap.

In our view, the downturn in the commercial telecom market will have had a short term impact on Optocap Limited, particularly given the backgrounds in this market of the staff involved, but its potentially addressable market is so huge that this downturn should not affect its long-run commercial success. The commercial revenues at Optocap Limited appear to be restricted currently by the lack of systematic marketing rather than by lack of commercial opportunities. We will revisit this theme in section 4.5.2 below.

The purpose of EDP is mainly to support commercialisation of optoelectronic technology emerging from Scottish universities. Much of the financial support for research in this area in the UK comes from the Engineering & Physical Sciences Research Council (EPSRC). In the view of the EPSRC, the level of support in this area has been largely unchanged over the period 2000 to 2005 at around the £15 - £20 million level[4]:

- In 2000 there were 39 grants awarded comprising £21 million
- In 2005 there were 33 grants, amounting to £15 million

Though we do not have figures specifically for Scotland, a working hypothesis would be that there should currently be as great a chance today of relevant technology flowing through the Scottish university system as was the case in

[4] Dr Emma King, Associate Program Manager, ICT Programme (Electronics), EPSRC.

2001-02 when the case for Optocap was developed. Our discussions with the Scottish universities generally support this working hypothesis.

In our view, there does not appear to be a fundamental limitation in the supply of EDP that would prevent Optocap Limited from supporting around 3 EDP per year in the future. We do agree, however, that the time required to fill the EDP pipeline was over-optimistic at the inception of Optocap; we revisit EDP and the targets set for this in section 4.5 below.

3 EVALUATION OF OPTOCAP'S INCEPTION

Question: What improvements could SEEL make to the approach taken with the Optocap Project when establishing future projects of this kind?

3.1 Method

Government economic/enterprise policy and the associated strategies for delivering the required outcomes and benefits always generate a large number of project ideas from both inside and outside government. Government therefore operates a rigorous project approval process to ensure that projects offer best value for money, low risk and high priority outputs. This approval process establishes the rationale for the government intervention, identifies the market failures that are being addressed and ensures that the project does not contravene state aid rules. The process also sets out the scope, the budget, the legal conditions as well as the project methodologies and the risk management necessary to deliver the target outputs. In evaluating the Optocap project, the approvals process was assessed to identify the strengths and weaknesses of the work done and also to recommend improvements in future project initialisation. This assessment followed the inside-out methodology and involved analysis of all the available approvals documents and in depth interviews with many of the stakeholders and officials involved in the process.

This evaluation is analysed from both a public sector and a private sector view of the processes. In the latter case our experience in setting up and running high-tech businesses identifies lessons from the private sector that are summarised in Appendix A and detailed in the appropriate topic sections of the report.

3.2 Approval process

The development of the Optocap Project (OP) took place over a 2 year period (Feb 2001-Dec 2002). The process followed the existing SE procedures at the start of the project but adapted towards the government's Treasury Green Book model as the initialisation developed[5]. From the timeline provided by SEEL the initialisation followed the model shown in Figure 3.1.

In all government inception projects this process is iterative with changes to the concept, risk analysis, governance, budget and demand being fed back into the assessment, review and planning phases. This was certainly the case for the OP project.

[5] The Green Book, Appraisal & Evaluation in Central Government, Jan 2003, HM Treasury

Within the OP development process there were also repetitive document updates and the need for approvals from both the SE and SEEL boards.

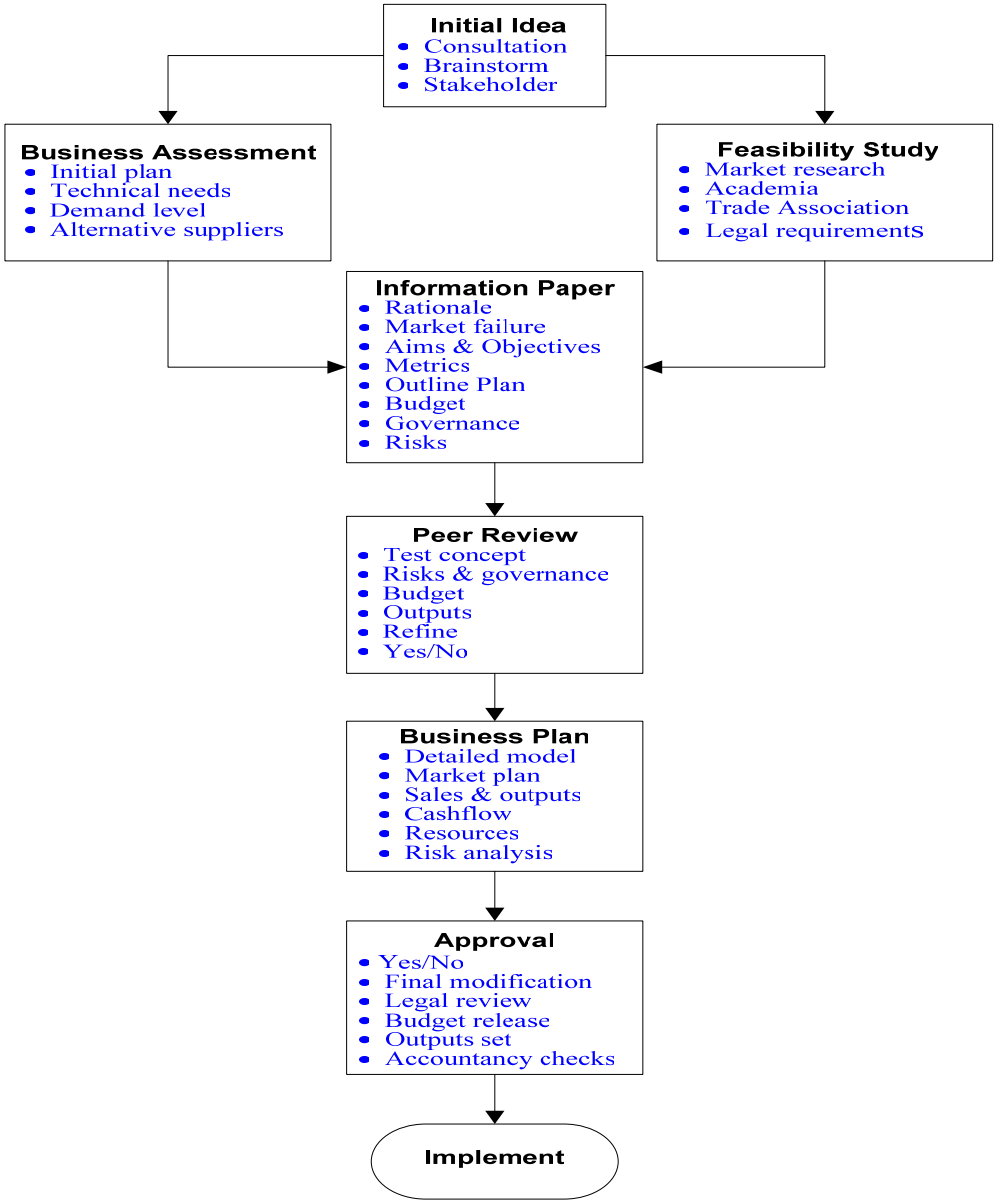


Figure 3.1 Optocap Project Approval Process

3.3 Lessons from approval process steps

In general terms the approval process was followed professionally with good attention to detail and focus on the economic development project. Within the process there were areas that should be treated as future project best practice and others that need to be improved. These are highlighted in the following sections. From the evaluation analysis it is noted that the Treasury Green Book is a useful best practice method, many elements of which could be helpfully used for future technology projects by Scottish Enterprise.

One activity that did not follow the process was the purchase of the packaging centre's capital equipment *before* the project was formally approved. Clearly, this was not strictly good practice, but it was driven by the unique opportunity offered by the closure by Nortel of its Paignton, Devon site and the resultant public auction of its optoelectronics packaging assets. The fortunate timing of this event provided much of the project's capital equipment requirements at a very low cost and also helped maintain the project momentum. The purchases were authorised by the SE Director of Clusters.

This decision reduced the project delivery costs by over £1m through a cost saving of circa 81%[6]. Whilst the financial benefits of this decision can be strongly justified there are issues about the appropriateness and risk of investing in a project before it is approved. Clearly, if the SE board had rejected the project at a later stage of the approvals process there would have been potentially damaging consequences. In going forward SE need to ensure that there is a rigorous decision process in place in case similar opportunities arise during future project developments.

3.3.1 Best practice employed in the approval process

The process evaluation revealed a number of the project development activities that in our judgement represent best practice and therefore techniques that should be captured by SE/SEEL and deployed for future projects. Summaries of these best practices and their specific improvements are given below.

a Scoping of demand (SOA Services)

A key part of the project development was the business assessment[7], market analysis, technology opportunities[8], facility planning[9] and business planning work[10] carried out by SOA Services Ltd. This SE funded work was carried out by packaging business professionals (ex Nortel and Texas Instruments staff) and

[6] Optocap Ltd Business Plan Brief, 3rd March 2003, SEEL
[7] Scottish Packaging Centre Model, March 2002, SOA Services Ltd.
[8] Packaging Technical Programme, August 2002, SOA Services Ltd.
[9] Staged Capabilities Plan, August 2002, SOA Services Ltd.
[10] Scottish Optoelectronics Packaging Centre, July 2002, SOA Services Ltd.

contains an exceptional depth of detail on the technical issues, market opportunities (both industry and academia), project risks and the centre's capability requirements. The quality of this work should be viewed as a major positive contribution to the development of the project since its depth of detail and business knowledge has made a major contribution to the scoping and project definition.

The best practice here is the use of commercially experienced resources to carry out detailed analysis of the sector aims and requirements. Their efforts made significant and timely contributions to the Business Assessment, Information Paper and Business Planning stages of the process. The use of this type of professional resource should become a standard practice in future project initiation work.

b Exploration of alternative suppliers

During the project development the SE team took a positive approach to investigating alternative suppliers and government projects. These alternatives included;

- **NWDA MNT Packaging Centre**
  This project has still not started and it might provide an MNT opportunity for Optocap going forward. (SG provided Optocap with contact for DTI programme manager to explore the opportunity.)
- **WDA Optic Centre**
  The review decided that this was not a confident alternative.
- **CIP facility**
  Only involved in private sector projects at the time, now a potential competitor for prototype and proof-of-principle devices.
- **TWI**
  Proposed service offering did not meet requirements.
- **Local start-up company** (specialised in laser systems)
  Proposed service offering did not meet requirements.

The best practice here was the positive investigation of alternative UK offerings that could deliver the required economic development outcomes for Scotland. This approach should be a standard research activity in future project development plans. This best practice would also ensure that SE meets the Treasury Green Book's Appraising Options requirements.

c Peer Review

The Peer Review Workshop held on 24th June 2002 facilitated by Precept Programme Management Limited[11] was another example of best practice. This internal SE stakeholder forum provided information on the project's objectives

[11] SEEL Information Industries Encapsulation Centre Report: Peer Review, July 2002, precept Programme Management Ltd.

and the expected benefits as a baseline for analysing the risks, their priority and the necessary steps to monitor and minimise the Optocap project risks.

This step did identify the following key risks:

- Affordability
- Ownership and transfer of IPR
- Staff access – costs, power/authority
- Subsidiary governance
- SE Control and flexibility of operation

The benefits of an externally facilitated Peer Review was that it provided a single event where all the key SE participants worked together to come up with a number of key decisions that focussed the development of the project. This team working based approach should also be considered for the key decision making points in the whole process.

d Risk management process

A comprehensive Risk Register exists for this project, categorising risks according to their probability of occurring, and the severity of impact which would result from their occurring. It describes risks and their causes, clearly identifies the risk owner and anticipated impacts, outlines the approach to handling each risk, and states mitigating actions. The development and subsequent management of the OP Risk Register satisfies the Treasury Green Book's Risk and Uncertainty best practice advice.

Risks for the project are extensively documented. There are 39 risks identified and assessed in the Precept Peer Review. These are re-assessed as 22 risks in the PWC Business Plan[12], with the top five risks highlighted and mitigation strategies outlined for each.

The top 5 risks were assessed to be:

- IP Transfer issues – unacceptable to all stakeholders
- Wholly-owned subsidiary model proves unacceptable to SE
- Management control of the centre is difficult given the conflicting commercial and economic development remits
- Recruitment and retention of key staff is difficult
- Failure to meet revenue targets.

When the second risk was overcome in the course of obtaining SE approval, the key risks dropped to four[13].

[12] OPC Business *Plan Final Report*, Price Warehouse Coopers, September 2002, Section 6 Risk Assessment, pages 26-32

[13] SEEL Board Paper December 2002 (page 4 and App VII).

3.3.2 Approval process actions that should be improved

Whilst the Optocap project development process was generally professionally delivered there were a number of areas where improvements need to be made for future projects in order to meet the Treasury Green Book best practice suggestions.

a Approach to establishing, and documenting, market failure and case for state aid

The identification and proof of market failure is a crucial factor in the rationale for intervention. The consultation work of SOA identified packaging and testing as weaknesses in the Scottish optoelectronic sector. It was also stated that commercialisation of academic expertise had led to 11 spin outs all of whom had major issues with packaging and encapsulation. Initial attempts to set up Optocap with private sector partners also failed. This was stated as proof of market failure, being due to the economic climate, technical risk and low rates of return. However, in the documents available from both SOA and SE/SEEL the research to prove these statements is not convincing. Unfortunately, SEEL could not find the original KPMG feasibility report from July 2001 to complete the picture. Best practice requires a more robust proof of market failure than quoted in the SE approval paper. In our judgement there needs to be research based evidence that justifies the value and cost of the market failure.

Legal advice on State Aids was stated to have been taken from legal firm Burness. The State Aids Unit at Scottish Executive appears not to have been consulted, but this is not mandatory, and the project owner retains responsibility for any decisions re notification to the EU. Our analysis of the rules (See Appendix 7.2) comes to the conclusion that Optocap Ltd does not provide distortion of competition and has no effect on trade between Member States of the EU; then the State Aid, which is undoubtedly present, should be legal[14]. Whilst it is not necessary to have notified the Optocap project to the EU, it is necessary to file proper covering documentation to defend the decision if necessary.

b Due diligence on scoping, and determining targets to suit

The SOA team developed a business led demand survey and claim to have identified up to 52 potential leads for the Optocap project. Whilst the interviews undertaken and market research carried out are highly detailed, the projections of sales levels were optimistic in both the academic and commercial sectors. The proposed number of academic projects[15] appears to be optimistic when

[14] Scottish Enterprise should take proper legal advice if it considers that this is still an area of doubt.
[15] Scottish Optoelectronics Packaging Centre, July 2002, SOA, Services Ltd.

compared to the detailed technical analysis[16]. The following table shows the results from the university interviews and confirms the over optimism of the original proposal.

University	Project	SOA Services Rating 2001	Comments
Strathclyde MEMS	MEMS phase shifter	Specific (Jan 03), very high priority	Interviewee at time has indicated that there was a background intent to commercialise but that these projects were a long way from being "EDP-ready"
	MEMS VOA	Speculative (no date), very high priority	
Strathclyde IoP	Packaging of micro-LED arrays	Specific (no date), high priority	Is now potential EDP project (IoP Micro LED Array)
	High Power III-V laser diode chips packaging	Specific (no date), high priority	There was never an intent to package these chips
	Optically pumped s/c VCSEL	Specific (no date), very high priority	Is now an EDP project (IoP VECSEL project)
	Laser/ detector co-packaged device for an external firm	Speculative (no date), medium priority	There was intent here to support an EDP but commercial partner pulled out
Glasgow University, Kelvin Nanotech	Microfluid PoC x2	2 bio projects rated as specific projects but without any other details	Interviewee at time cannot recall the details of projects discussed, casting doubt on specificity of these projects
	Silicon micromachining PoC	MEMS project rated as a specific project but without any other details	

Equally, the projected commercial market seems high on both the proportion of company turnover available for packaging (70%) and the value of project opportunities for Optocap Ltd. ("OPC revenue estimates are £618k in year one growing to £932k in year 2.")

Whilst the SOA team made a major best practice contribution to the project development there was insufficient testing of their market and budget decisions. As the sector trade association with a strong academic membership, SOA had an agenda in pushing for the setting up of the Optocap facility. Their earlier work with the SE cluster team had identified the Optoelectronic Encapsulation Centre as a high priority requirement for the SOA and its members. This potential bias should have been balanced by employing an independent organisation to validate (or challenge) the Business Plan stage. The PWC business plan[17] does not achieve this objective with major parts of the PWC plan containing wording and data that are identical to those in the earlier SOA Information Papers. The

[16] Scottish University Technology Opportunities, August 2002, SOA Services Ltd.
[17] Scottish Optoelectronics Business Plan Final Report, September 2002, PwC

PWC report recognises this and contains a prominent caveat about re-use of others' data

Over-optimistic assessment of demand and sales is a known tendency for project developers. This is a global phenomenon that affects both the private and public sectors[18]. Project developers tend to overstate benefits, and understate timings and costs, both capital and operational. To redress this tendency, SE should in future make explicit adjustments for optimistic bias. These need to be financial analysis that increases cost estimates and decreases, and delays the receipt of the estimated benefits. Sensitivity analysis needs to be early in the process to test assumptions about operating costs and expected benefits.

The rigorous use of SMART targets as a best practice could help in focussing on the achievement of realistic targets for future projects. An assessment of this project against SMART reveals the challenges.

SMART	Assessment	Recommendations
Specific	Yes for 9 EDP's but vague on commercial outputs	**Desirable -** Tighten up target definitions
Measurable	Yes	**None**
Achievable	Yes	**None**
Realistic	No as the University projects were not tested and original project list was over ambitious	**Desirable –** Need to check for over optimistic bias and assess original target realism.
Timebound	Yes in defining project although delays in EDP project starts will extend the time limits.	**None**

c Economic development benefits

In reviewing the project status the Peer Review workshop did highlight a weakness in the definition of the project's benefits to the Scottish economy and therefore the difficulties in monitoring/evaluating the project at key points in the lifecycle of the project. Best practice requires that the financial assessment of benefits and costs is developed very early in the project development. The final approval document[19] does contain some economic benefits in terms of jobs created (250-279), but there is no time profile or benefits in terms of GDP or GVA (Gross Value Added).

[18] Underestimating costs in Public Works Projects – Error or Lie, APA Journal, 2002.
[19] Integrated Optoelectronics Encapsulation Centre, Approval Paper, SEEL Information Industries, December 2002.

In future projects SE/SEEL need to ensure that there are stronger calculations and justifications for the economic benefits of the intervention projects against the costs to be incurred.

d Early choice of ownership model

The SEEL Board Approval Paper (Dec 2002, App VI) offered two options for project delivery, an equity model and a guarantee model. The equity model, in the form of a wholly owned subsidiary, was the chosen option.

The model for the Optocap delivery company was a prime concern and the guarantee model was initially assumed in all of the project documentation. This is a conventional, de-facto standard governance model and is a comfortable model for public sector interventions and the involvement of academia. However, towards the end of the project development it became clear that the anticipated exit strategy of movement into the private sector would be a major challenge if the guarantee model was adopted.

It was therefore decided to move to a "Company limited by shares" with 100% ownership by Scottish Enterprise. This provided a flexible set-up for the future exit strategies and would avoid the legal costs (~£300k[20]) of changing from the guarantee model. This non-standard (for the public sector) model did require the formal approval of the Scottish Executive, whereas companies limited by guarantee do not need Executive approval.

This switch in governance was a key issue for the project, but the change happened very late in the project development. Indeed, the SEEL Board Approval Paper (Dec 2002, page 3) mistakenly states that the project would proceed under the guarantee model. As a result of the new model it was decided not to have any university participation in the ownership of Optocap.

Given the benefits seen by the use of this more business focussed governance model it is suggested that SE should look in future to specify this model at the start of the approvals process for similar projects. This will also help to focus the project manager on securing appropriate Board members from an early stage.

e Robustness of exit strategy set at the outset

As with all economic development projects, Scottish Enterprise requires to have in mind from the outset an exit strategy for the project. The SEEL Board Approval Paper (Dec 2002, page 5 and App X) outlines four exit options, of which the preferred one involves commercialisation through management buy-out and attracting in external finance. In our discussion on exit options in section 6 below, we call this the 'financial investor' option.

The *Business Plan Narrative* of March 2004 states further that at the end of 3 years (i.e. Feb 2006), "Optocap is to be spun out as an independent commercial organisation". This is clearly not now achievable, since the company is still

[20] Interview with Scott Wilson

running a large deficit and has no significant equity portfolio or IP position to exploit. In our view the basis on which the preferred exit strategy was chosen was not robustly challenged at the time. There are a number of issues to be considered here:

- The Approval Paper (App X) double counts the potential benefits from EDP projects, adding the potential income from equity investments to those from licensing agreements. We do not think, from our reading of the PWC business plan, that this interpretation was intended by PWC.
- The PWC business plan assumes equity realisation of up to £2.8 million in Year 7 and the Approval Paper delays this by one year. This potential uplift in value assumes that all EDP are contracted on an equity basis. In practice, all but one of the EDP have been contracted, or have been agreed to be contracted, on a deferred payment basis. This could have been anticipated at the time and reflected in the modelling by PWC[21]. The equity positions were the main item that made it appear that Optocap would be an attractive investment opportunity and that Scottish Enterprise could realise a return in excess of its original investment.
- The preferred exit was likened in the Approval Paper to that deployed with CST. By March 2004, however, it should have been clear to the Optocap Project management that the climate for financial investment in the optoelectronic sector had changed significantly, and alternative strategies should have been considered again at that time.

The exit strategy is a key element of any private sector investment and much attention is paid to modelling the range of financial outcomes. In the case of Optocap it appears that some lightweight assumptions were used to demonstrate that the business model could create value that might appeal to financial investors. A key learning for the future should be that financial modelling of the exit strategy, and robust testing of the assumptions underlying the strategy, are as important as modelling of the operating cash flows.

A subsidiary lesson is that the project managers at Scottish Enterprise should consider the exit strategies, together with the CEO, from an early stage and on an ongoing basis, and seek to modify the strategy when the original assumptions are invalidated. In other words, exit management as well as operational management should be a clear part of the project manager's remit that is regularly reviewed. From our interviews it appears that the exit strategy was addressed systematically from April 2005, after Ian Blewett became Chairman[22]. From this point the exit strategy has been a standing agenda item at Board meetings and discussions with potential investors have taken place. This was nearly two years after recruitment of the CEO, however, and the exit strategy

[21] This is not a criticism of PWC, which appears to have been operating within a very limited remit when finalising the Business Plan. Indeed, the potential uplift from equity positions were not part of the final financial projections and were included for illustration.
[22] Interview with Ian Blewett on 16 January 2006

should have been reviewed regularly (perhaps every six months initially) during the first two years of the project.

3.4 Lessons from process flow

In assessing the initialisation and approval process the most immediate issue is the 22 months between the start of the process and the final approval. The impact of globalisation and the competition within high technology markets is continually reducing the time to market for new products and processes. It is therefore crucial that SE examines ways of speeding up its decision making processes if it is to continue to deliver positive technology cluster interventions.

The project timeline (Figure 3.2) shows that very little progress was made in 2001, whilst in contrast the majority of the process was successfully executed in 8-9 months of 2002.

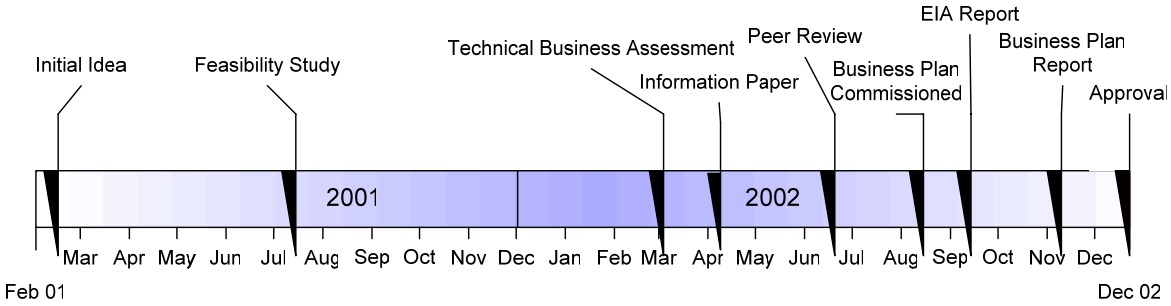


Figure 3.2 Optocap Project Initialisation Timeline

Discussions with the stakeholders around these delays revealed the following root causes of the initial delays;

- No clear project development process or plan
- Lack of a defined decision process
- Need for Director level sponsorship in SE for this type of project
- Fixed monthly SE and SEEL board meetings delayed decisions

The importance of the first of these issues became clear when a series of Microsoft Project plans for the approval and implementation process were examined. These plans were created in February-March 2002 and although the December completion was 3-4 months behind the original plan it is clear that the plans identified all the actions (internal and external) necessary to deliver the initialisation. From the change in performance these plans also looked to have motivated and driven those involved.

From the evaluation a number of recommendations can be made to speed up the process without contradicting SE's goal of achieving a rugged approval process, thus:

- Develop and implement a well defined phase gate process that meets the Treasury Green Book best practice suggestions.
- Use the Peer Review team working model for the early gate decisions.
- Appoint a Director to lead each new project idea and mentor the project manager.
- Ensure a formal project plan is created and managed for each project to establish milestones and deadlines for the key research, analysis and gate decisions. The appointed project manager should create and communicate the plan at the start of the approvals process.
- Arrange an e-approval process for project changes requested by SE or SEEL board meetings. OR,
- Delegate an Executive member to make decisions between meetings, within certain parameters, which can then be "homologated" (i.e. endorsed), at the next Board Meeting and minuted (e.g. SE subsidiary AtlasConnect Board).

These lessons have already been taken on board by SE/SEEL and accordingly a new internal project initialization process has been developed. A Projects Lifecycle Initiative was started in March 2005[23] with a planned implementation in October 2005. A new Major Project Gateway Process has been developed and trialed by SEEL staff for projects requiring >£2m public funding and/or significant risks in implementation. This new best practice process was specified nationally by SE through the internal release of Project Lifecycle guidance documents in October 2005[24] [25].

These new documented processes appear to meet the above best practice recommendations, but it is too early in the life of the changed procedures to establish the performance improvements achieved. This will require a future independent evaluation study. However, SEEL staff did indicate confidence in the ability of the new gateway process to speed up the project start-up timelines.

A suggested phase gate process based on the Generics Group's Investment Engine model is described in Appendix B to provide a comparative model for the SE major project gateway process.

Having developed a best practice process the key issues for the future are the implementation, monitoring and maintenance of the project initialisation procedures. At this early stage the lessons from the Optocap project that should

[23] SE Executive Board Paper, Network Operations – Change Agenda: Projects Lifecycle Initiative (no 23), 15 March 2005.
[24] Scottish Enterprise Projects Lifecycle Procedure & Guidance : Project Initiation Document, version 1.0, SE, 31 Oct 2005.
[25] Project Initiation Document (PID) Full Version, v1.0, 31 Oct 05

be applied to the gateway tasks around the creation of a similar high tech initiative are;

- Ensure all staff are trained in the process tasks
- Maintain internal communication to inform staff of relevant changes to the process and the project progress
- Establish, monitor and maintain an appropriate plan for the project initialisation.
- Use external professional resources to provide detailed research and planning to establish the demand and scope of the project, e.g. SOA model.
- Avoid duplication of external work packages (i.e. only 1 example of detailed business plan, market research, economic assessment)
- Ensure that there are independent checks on market assessment to avoid over optimistic scoping of project.

4 EVALUATION OF OPTOCAP'S DELIVERY

Question: How well has Optocap Limited performed in achieving the Optocap Project objectives, taking account of any changes in the market for its services?

4.1 Method

Following the approval process the project moves into the implementation phase, where Optocap Ltd. was set up as the delivery mechanism for the project. The evaluation of this stage will look at the processes and governance issues established at company start-up, followed by examination of the company's operational performance and operational processes.

4.2 Company start-up

The implementation of the Optocap Project (OP) took place over a relatively short 10 month period (Dec 2002-Oct 2003). The process followed a straightforward plan and although there were inevitable issues to deal with the implementation was completed effectively.

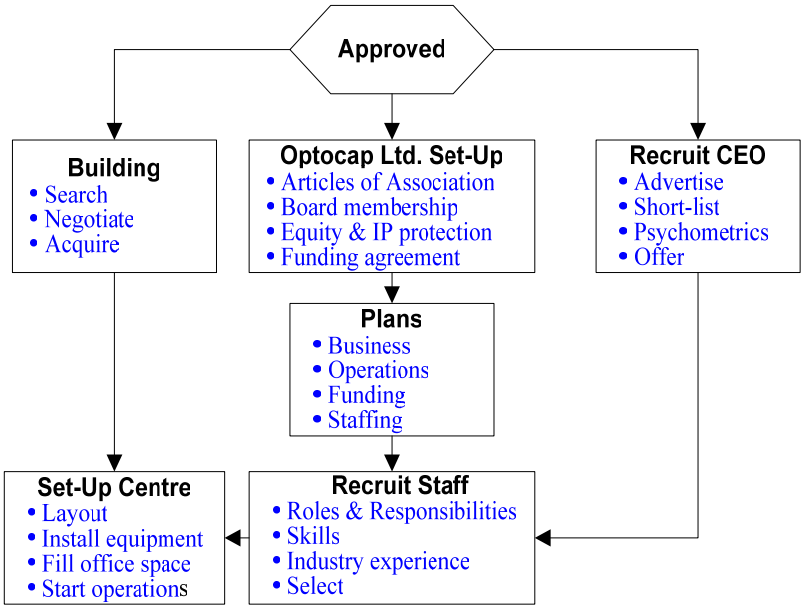


Figure 4.1 Optocap Implementation Process

4.3 Lessons from start-up process

The implementation process was well planned and delivered effectively within 8 months as shown in the detailed project timeline (Figure 4.2).

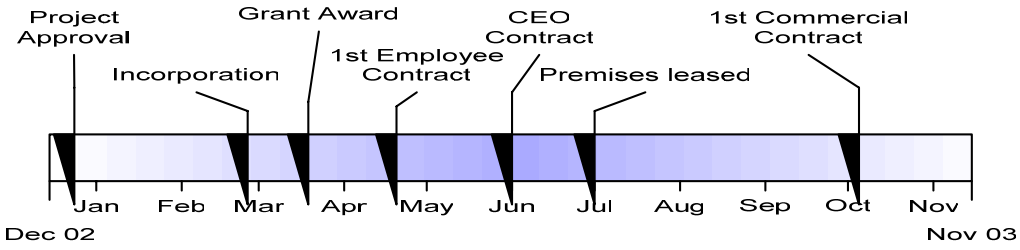


Figure 4.2 Optocap Project start-up Timeline

In assessing the plans, documents and procedures used during the implementation process, it is clear that the setting up of Optocap Ltd. was performed professionally with a rugged approach to protecting the special rights of Scottish Enterprise.

The governance tests applied to the start up process identified some issues for future consideration but most of the tests show that Optocap is compliant and was set up with a professional approach to managing and operating the public sector project. Details of the governance assessment and recommendations are presented in Appendix G, but the key lessons are presented in the following 2 sub-sections.

4.3.1 Best practice employed in the start-up process

a Project Planning

Following the December 2002 approval the project manager created a detailed project plan that identified all the key milestones and activities necessary to implement the project. The creation and management of the project plan is an important best practice in the delivery of an efficient company start-up. SE have captured this best practice in the new process by making appropriate project planning methodology a mandatory requirement for future projects. It has to be recognised that the public sector best practice model PRINCE 2 is not always the most appropriate project planning methodology and therefore in some projects other methods may be more effective.

b SEEL Chairman/Project Manager dual role

In the private sector it is regarded as best practice to set-up a board structure that contains a representative of the main investors who also provides strategic and operational guidance to the company management. Hence, the appointment of the SEEL project manager as chairman could be regarded as a best practice decision.

However, in the public sector there are concerns that someone responsible for leading the company who is also leading the government project (the funding source) could represent a conflict of interest. SEEL have managed this potential conflict by ensuring that the chairman does not make the grant payment decisions for SEEL. In addition, the project manager is not remunerated separately for the Chairman role and has no stake in the company. His role in the company can be regarded as an extension of his economic development remit within SEEL, as long as that role is extended into the company by virtue of SE's 100% ownership and the strategic purpose to which the company adheres.

4.3.2 Start-up process actions that should be improved

Generally, the implementation process was well managed and executed, but there were some issues where improvements could be made to achieve total best practice.

a Board composition, advisory board

The current board structure does not reflect the original SOA advice. Under the Articles of Association, SE must have a simple majority of board members to ensure that SE's 100% ownership is protected. Whilst this structure is appropriate for the start up stage it does not represent best practice for a company seeking growth in a commercial market environment. The SEEL Optocap chairman has the real benefit of being a former business person in the optoelectronics sector. However, it is also important that the board has a highly credible industry member to drive Optocap's commercial interests and keep the service offerings and IP relevant to the industry needs.

To achieve best practice the board structure needs to reflect the future needs of Optocap Ltd. with a balance of board member skills to support the company. The board definitely needs entrepreneurial and sales/marketing experts to help drive the company forward. This will allow a more business focussed drive for the company.

The board structure can be revised to ensure that SE's special ownership rights are protected. The following three options are possible:

- Appoint a non-voting Director to the Board - this is very unusual in the private sector since non-voting Directors have the same legal responsibilities as voting Directors. It is therefore unlikely to find anyone to agree to this role.

- Appoint an Observer to the Board - this person can attend Board meetings and provide advice, but does not vote and cannot call himself a Director. The voting Board members must also be careful to ensure that they make their own decisions and do not just agree to everything suggested by the Observer. An Observer can be appointed by the Board without the need to change the Articles of Association. Optocap should be able to find someone that would agree to this role, if paid appropriately.

- Change the voting structure to a veto system via a modification to the Articles of Association[26]. In this solution the Board can be augmented to allow Scottish Enterprise (SE) representatives to be outnumbered by other Directors under normal circumstances. On critical matters, however, SE can invoke increased voting rights to command a majority. From the perspective of potential Board members this appears to be little different to the option of appointing non-voting Directors (see above), since non-SE Directors will still have full legal responsibility but will not have control over critical issues related to the company.

The advisory board also needs to reflect Optocap's future business. The inclusion of a VC person is best practice, but there are too many existing customer representatives and too few senior business representatives. Again there is a need for a broader range of business expertise (not just SME's) and for representatives of the new biotech, MEMS and silicon markets.

b CEO not given Director status

The employment and retention of a highly capable CEO is vital to the success of this and any similar future projects. In setting up the Optocap board structure it was decided by SEEL that the CEO would not be allowed a Director status. Whilst this minimised the need for the number of SE/SEEL Directors at the board meetings it is a significant disincentive for the recruitment of high performance industry individuals.

c Initial targets for CEO were vague

The initial targets given to the CEO were vague and only quantified the completion of 9 economic development projects (EDP)[27]. The subsequent board meetings and the annual performance reviews have now significantly improved this situation, resulting in quantified targets and increased focus for the business (see section 4.4.1b for more details).

[26] This option was suggested by Ian Blewett and is being implemented in other SE projects.
[27] Optocap CEO Infopack, March 2003, SEEL

In future projects, the initial targets should be related to a stronger cost and benefits analysis to present a range of quantified targets that will drive the project from day 1 and represent a focus on SE's required benefits. The use of SMART objectives during the initialisation phase would help this process achieve best practice targets.

d Packaging facilities

The capital equipment within the Optocap facility is of good quality and covers a broad range of manual packaging and testing requirements. The equipment assets are acceptable for the current prototyping and low volume manufacturing activities. One concern is the lack of any clean room facilities within the company. In optoelectronics/photonics packaging and assembly organisations across the world class 10,000 clean room facilities are the standard packaging facility. In a sector where micron scale alignment of fibres and lenses are required it is important that any packaging facility can deliver high quality sub-assemblies with very low particle counts. Additionally, if Optocap is going to move into a more commercial market environment as well as into new sectors such as biotechnology and MEMS it will need to offer Class 10,000 general facilities with some higher quality laminar flow stations for critical quality equipment operation.

This will obviously increase its capex and running costs expenditure but it should also improve its marketing offering and commercial revenues.

The board and CEO are aware of this shortcoming and are looking at the future market needs and the potential space that could be used for cleanrooms when the space they rent out to start-up companies becomes available.

4.4 Operational review

We have conducted a review of the operations of Optocap Limited tailored to the requirements of a SEEL Internal Audit[28] and the Gate 4 review, within the constraints of time and budget. The detailed results can be found in the Appendices to this report. We have also interviewed a sample of the EDP and commercial customers of Optocap Limited in order to establish how well the operations support customer requirements in practice. The list of customer interviewees can also be found in the Appendix C.

In this section we present the most important findings of our review and interview programme. There were also a number of other areas highlighted by the review where some corrective action from the management of Optocap Limited should be considered, but that we regard as being of minor operational importance; to

[28] As given in Scottish Enterprise Edinburgh and Lothian, Internal audit, Review of Optocap Limited, September 2004

ensure compliance with the SEEL audit and best practice (see Appendices G and H for more details):

- insurance levels should be reviewed in the light of recent / planned investments and increased commercial revenues
- the conflict of interest register internal to Optocap Limited should be reviewed periodically (perhaps every 6 months) at meetings of all employees
- invoices should be signed off by Project Managers before entry to SAGE
- job descriptions should be written for all employees
- the Excel-based asset register should be updated to include the purchase date and price of all items
- a periodic (perhaps annual) detailed external audit of H&S systems should be considered
- a simple system to predict forward loading of all employees more accurately should be considered
- financial variances should be reported to the Board quarterly or bi-annually

In the following two sections we first review the operational strengths of Optocap Limited, and then move on to consider important weaknesses that should be addressed by management as a matter of urgency.

4.4.1 Strengths of Optocap Ltd

a Good customer feedback

In order to make customer feedback anonymous we have combined multiple customer inputs into an overall score for Optocap Limited against critical areas that will largely determine its success in the market ("key factors for success" or KFS). The score against each KFS and additional comments for each KFS are shown in the following table.

Key Factor for Success	Overall Customer Rating	Customer Comments
Ability to design packages to international standards	Good	• Strong on detailed execution of chosen designs • Adds significant capability to university sector • Less strong on exploring totality of potential solutions • Relatively weaker in wide application knowledge and associated standards outside of telecom market (e.g. medical, oilfield)
Responsiveness to clients	Excellent	• Universally praised by both EDP and commercial clients • Behaviour is exceptionally professional and in line with industrial norms
Quality of production (prototype build execution)	Good	• Some errors in initial builds for clients • Rapidly troubleshoot and eliminate identified errors • Ongoing production quality is acceptable
Price	Good - Excellent	• General satisfaction with pricing overall • Project management fees on the high side
Overall	**Good - Excellent**	**Very good feedback for a relatively new company**

Our interviews indicate general satisfaction with the performance of Optocap Limited, for both EDP and commercial projects. The areas where the management should apply its focus on potential improvement are:

- establishing a tighter and more strategic network of experts, most probably independent consultants, to support design & manufacturing work in areas outwith the experience of the current employees, particularly for medical and biotech applications
- improved quality control by senior engineers in the early stages of production build, to reduce the incidences of initial build errors

b Clear target setting and monitoring now evident

The targets set by the Board for the CEO are now clear and time limited. Performance levels have been set that accord with 'Fair' and 'Excellent' levels, and which are quantitative for both EDP and commercial areas.

In turn, the CEO has devolved his own targets to matching targets for the three senior engineers who are also members of the bonus scheme.

The CEO and three senior engineers are reviewed annually against the targets set the previous year and their bonus is determined by their performance against the targets.

After a slow start in terms of target setting (see start-up process above) the practice in this area is now exemplary and beyond that found at many entirely commercial companies.

c Clear priority for EDP is evident, without impacting commercial delivery

From the perspective of SEEL, it is important that Optocap Limited maintains its focus on EDP since supporting these is its primary purpose. It is also critical from a state aid perspective that only spare resources are allocated to commercial projects.

Possible conflict between EDP execution and commercial projects was anticipated in the Risk Register from the outset, as the second of the four most significant risks (high impact, high likelihood). SEEL Board Paper Appendix VII identifies the risk as "Control of the Centre becomes chaotic … a significant risk exists that the direction required by SE will compromise the business's ability to manage itself effectively and efficiently".

It is clear from our interviews with the university sector that Optocap Limited has done its utmost to progress potential EDP. Delays in signing contracts have arisen only from the customer side; Optocap Limited has been very responsive in adapting its proposed approach to providing a technical solution and in resolving

any contractual issues. This responsiveness has even extended, in the last few months, to the level of performing pre-contractual feasibility studies for potential EDP clients. Feedback from customers on the execution of EDP is also positive.

In our judgement, the clear target setting and regular Board monitoring has borne fruit at the operational level in the approach of the staff to EDP support. Furthermore, the positive commercial customer feedback demonstrates that this proper focus on EDP has not compromised the service provided to commercial customers.

4.4.2 Weaknesses of Optocap Ltd

a Financial control is lax in some areas

In our view this is the most serious area of process concern at Optocap Limited. There are a number of lax controls which are, in order of importance (see Appendix for more details and possible remedial action):

- the CEO is able to execute electronic BACS payments alone and without any preparation and / or verification by other employees or Directors
- a single signature can execute cheques up to £50,000
- credit checks are not routinely obtained for new commercial customers
- invoices for commercial services are triggered by project managers and not automatically
- commercial project consumable costs are not assigned to individual project codes

The controls around the execution of bank payments (BACS payments and cheques) are particularly lax and, in our view, most unusual and should be re-appraised as a matter of priority by the Directors perhaps with some specialist accounting support. The authorisation procedures for payments, however, are appropriate and well understood by the staff.

The key improvements that we suggest in the area of execution of bank payments are:

1) All cheques should require two signatures (CEO and Director, or CEO and assigned staff member of Optocap Limited)
2) BACS payment execution should involve two members of staff of Optocap Limited, one of which should be the CEO

b Too much operational contact with Optocap Project manager

Ian Blewett has a dual role as the Optocap Project manager and as a Director of Optocap Limited. As described in the Appendix, this type of dual responsibility is common in the private sector where venture capital funds seek to monitor and

guide their investments. In normal circumstances, however, venture capital funds also prefer to allow the CEO to manage without day-to-day interruption.

Weekly meetings are currently scheduled between David Ruxton and Ian Blewett, and these meetings take place when both are available. These meetings are used both to execute director authorisations (e.g. cheque signing) to discuss progress and to coach the CEO (whose experience is in the private sector) on the specific requirements of the public sector. An additional benefit of these meetings is that the monthly Board meetings are made more efficient[29].

Whilst these meetings are not in any way resented by the CEO, who recognises the stricter governance requirements of the public sector, their regularity is inappropriate at this stage of the project delivery.

From our knowledge of the private sector we would normally recommend that meetings should take place only on a monthly basis. Since Board meetings occur approximately once a month then the need for additional meetings between David Ruxton and Ian Blewett (outwith the Board meetings) should be minimal – additional quarterly meetings that focus on longer-term strategic issues would normally be sufficient.

Given the desire to make the Board meetings more efficient, however, and taking into account the current focus at Scottish Enterprise on close monitoring of its investments, additional meetings ahead of Board meetings may be justified from the perspective of the Optocap project manager.

c Project effort monitoring does not exist

There is no time booking system at Optocap Limited, and this is a serious shortcoming for a project-based company. Without time booking it is not possible to say whether commercial projects have been profitable, nor whether EDP projects have been priced appropriately. It is also more difficult to monitor the contribution of all staff to the success of the company if effort on projects is not monitored.

We recommend the introduction of a simple time booking system. This would support, in time, accurate estimation of project effort and reliable pricing – this will become increasingly important for commercial work going forward. For larger commercial contracts (or for EDP paid by contract rather than by grant) it would also allow for invoicing based on effort expended each month.

d Appraisal & training is very weak

As mentioned above, the CEO and three senior engineers of Optocap Limited have clear targets and are members of a performance-based bonus scheme. These four employees therefore undergo an annual appraisal. The remaining

[29] Interview with Ian Blewett on 16 January 2006

staff members, however, have neither a formal performance review nor specific annual targets. Instead, they are provided with informal, day-to-day feedback from the senior team members.

Furthermore, there was only a very small budget specifically allocated in the grant for training of staff (£5k p.a.). Training, as a result, is on-the-job and linked mainly to the operation of production equipment.

This situation is quite typical of small companies but does not represent good practice. The more junior members of staff must also be made to feel that they are growing in their jobs and adding to their general attractiveness to employers. The best way to ensure that this happens is to set specific targets and to monitor the outcomes. Training on more general IT and communication skills should also be funded where required; the investment is usually modest compared to the cost of recruiting a replacement.

We therefore recommend that annual performance reviews for all staff are introduced and that personal aspirations, targets and associated training requirements are discussed at these reviews.

4.5 Performance review

4.5.1 EDP projects contracted versus targets

The original target for EDP, set in the grant document, was for 9 projects in three years – anticipated to be executed as three projects for each year of the grant period[30]. The performance against these original targets to date appears to be modest, as shown in the following table. We have taken the years to begin from the date of recruitment of the CEO rather than from the grant date.

EDP projects contracted	Jun 03 – May 04	Jun 04 – May 05	Jun 05 – May 06
Target in grant	3	3	3
Actual / estimated	0	2	3 estimated

The number of projects for the year to May 2006 is taken as the one actual contract signed in September 2005 (with Strathclyde University) plus our estimate of two additional projects that are likely to be signed before May 2006. We have formed an independent estimate of the quality of the current EDP pipeline by interviewing the potential EDP customers directly. Our qualitative assessment of the pipeline is shown in the table on the next page.

[30] "…the OPC is in a position to service…three of these projects annually…", PWC Business Plan, p41.

A number of these projects have actually been in progress since SOA Services first performed its survey in 2001, as discussed above. The reality is that it takes many, painful and iterative steps to bring an idea to the stage where it might need packaging. Whilst it would be desirable to speed up this iterative process, the reality is that Optocap does not have the ability to influence key decisions that are made at these other organisations.

In our view, the original target of 3 EDP projects per year was a reasonable ambition for steady-state operation of Optocap Limited but was far too ambitious in the early years in retrospect. There does not appear, from our customer interviews, to be anything more that the company could have done in order to secure more EDP contracts in these early years. Indeed, the company was pro-active in identifying that small start-up companies should be EDP clients in addition to university spin-outs[31].

[31] Optocap Limited Board Meeting minutes, 30 August 2004.

Pipeline Position[32]	Project	Current Situation	Comments
Probable in next six months	Glasgow Uni. Lab-in-a-Pill (LIAP)	Waiting for external investment in the LIAP opportunity - Glasgow Uni. is unwilling to proceed in advance of funding due to additional legal costs of investors	~50% chance of starting before May 06
	Heriot Watt Optical Encryption	Feasibility study nearing completion	May be in contract in December or January
	Optilock	Feasibility study nearing completion	May be in contract in January
	Speknet Speks	Edinburgh Uni. waiting for some components before assembly work is needed by Optocap	It is doubtful whether this can be counted as an EDP[33] as it comprises only small assembly support by Optocap (contracts of ~£1000)
Probable beyond six months	IoP Micro LED Array	Waiting for external investment to finance market study and production of prototype devices	Will investors really pay to do a market study? A long delay is likely
	IoP Plastic UV LEDs	Clear intent by IoP to collaborate, Optocap involvement will be paid out of PoC funds	Dependent on PoC funding, which has been applied for but is far from being guaranteed
Probable, unspecified timing	Strathclyde Uni. MEMS	There are no specific MEMS EDP projects in the pipeline	Strathclyde is keen to collaborate but this is not yet a specific EDP
	Strathclyde Laser Box	Not evaluated to date	

[32] Pipeline position is as supplied by David Ruxton

[33] EDP were envisaged as major projects of around £250,000 cost each that required expert input on packaging design. It is very doubtful that small assembly tasks with no design input can be claimed as matching these expectations.

A clear learning point for future interventions targeted primarily at the university sector is that a soft start is needed in terms of EDP targets, to allow for the long incubation times of such projects to play out naturally. A more reasonable set of annual targets would be as given in the following table.

EDP projects contracted	Jun 03 – May 04	Jun 04 – May 05	Jun 05 – May 06
Realistic target	1	2	3
Actual / estimated	0	2	3 estimated

To contract for even one EDP project in the first year would have been challenging, of course, given the actual outcome but this target would have maintained a clear focus on EDP projects for the management team from the outset. It is possible that Optocap Limited will hit a total of six EDP contracts by the end of its third year if the Glasgow LIAP project achieves its funding aims. We would consider support for six projects over three years to be very good performance and for five projects to be good performance, given that the constraints are not imposed by Optocap.

4.5.2 Commercial revenue versus targets

A comparison of delivery of commercial revenues against the grant assumptions is given in the following table.

Revenue	Jun 03 – May 04	Jun 04 – May 05	Jun 05 – May 06	Total
Planned	0	£100k	£250k	£350k
Actual	~£15k	~£180k	~£275k	~£470k

The commercial revenues were much better than originally planned in the year to May 2005 but below the target subsequently set by the Board of ~£250k. The performance against the original targets appears to be excellent due, in part, to a lack of EDP work. The performance against the targets set by the Board, however, is only good.

Furthermore, in our view the targets set to date for commercial revenue have been modest given the assets deployed at Optocap Limited and the lack of EDP projects to support. The commercial revenue target for the CEO for the year to June 2006 is still only £300k, set against an annual cash outflow of ~£880k estimated for the year to March 2006. As the Board should have been looking for exit opportunities, it should have been much more aggressive in its target setting in this area. We will revisit this issue in section 5 below.

In our view, Optocap has a multitude of potential customers in a wide range of sectors. The key issue is to make customers aware that Optocap exists and to publicise its true capabilities. Our interviews indicate that Optocap is little known outside of Scotland even in the telecom sector and that it could be much more

active in marketing to its non-telecom markets. Even down to the basic level of optimising its web presence, Optocap is currently poor at marketing. The marketing budget should be significantly increased in 2006 to include:

- Advertising in trade publications, particularly in life sciences, MEMS and semiconductors
- Presence at a wider variety of trade shows
- Presentation at key conferences, highlighting the successes to date
- Mail drops to targeted commercial companies in sectors of interest
- Improving the web site, and perhaps investing in sponsored links with search engine providers

The board are aware of this problem and have been working to recruit a Business Development Manager since January 2005[34]. An offer was made in May 2005 but was turned down in June resulting in the CEO taking on the business development role from August[35] . Our evaluation indicates that OL need to re-double their efforts to increase the business development resource in order to improve their sales and marketing performance. This is particularly in recognition of the difficulties in finding and recruiting someone with the required skills and experience.

4.5.3 Grant draw versus expectations

The planned levels of grant funding and the actual levels delivered and forecast are shown in the following table.

Grant funding	Mar 03 – Feb 04	Mar 04 – Feb 05	Mar 05 – Feb 06	Total
Planned[36]	£1,370k	£1,046k	£1,139k	£3,554k
Actual / forecast	£1,046k	£995k	£340k[37]	£2,381k

The grant funding is now delivered as requested by the CEO based on the actual level of quarterly deficit, with the aim of maintaining a minimum bank balance of £100k. The CEO has taken a prudent approach to building up delivery capability. When combined with commercial revenues above the level assumed in the grant

[34] Optocap Board Meeting Miunutes, OL, 18th Jan 2005.
[35] Optocap Board Meeeting Minutes, OL, May, June, August 2005.
[36] For planned capex we have split the £870k in the grant award by year in the same proportions as implied by the PWC business plan: Year 1 – 51%; Year 2 – 14%; Year 3 – 35%. In practice there was no clear plan for capex by year known to the CEO.
[37] Includes forecast by David Ruxton of grant required during the rest of this period. The funding forecast for 2006 is particularly low due mainly to a build-up of cash in 2005.

plan, there is £1,173k[38] estimated to be available for Optocap Project execution beyond the planned three year period[39].

With the current level of cash burn the company should be able to survive without additional support for perhaps two years beyond the original three years planned.

Given this additional time it should be able to deliver at least 10 EDP projects over a five year timeframe without additional funding.

[38] Simply taken as the difference between the planned grant of £3,554k and the grant disbursed to date, which amounts to £2,381k.
[39] This includes ~£100k set aside to pay for this review and other services related to evaluating the Optocap project rather than strictly operational costs of Optocap Limited.

5 EXIT STRATEGY

Question: What should be the future ambitions for the Optocap Project / Optocap Limited and what should be the exit strategy?

5.1 Method

In this section we will set out our view of the feasible exit options for Scottish Enterprise. We will then show the targets that should be set for Optocap Limited to support the most attractive exit option. In doing so, we will take account of the desire of Scottish Enterprise to continue to support EDP whilst reducing its financial exposure to Optocap Limited.

5.2 Assessment of Strategic Options

The strategic ownership options potentially open to Scottish Enterprise can be considered along two dimensions. The first dimension considers the level of ownership retained by Scottish Enterprise in Optocap Limited. There are three basic options along this dimension[40]:

- **0%** ownership i.e. complete exit
- **Minority** ownership, without any executive control
- **Majority** ownership, which confers executive control

The purpose of retaining an ownership stake would be to try to retain control of the company, to maintain a financial investment that might grow, or both.

The second strategic dimension considers what type of investor might buy a stake in the company. There are three main options:

- A **trade** investor might buy Optocap for its technical expertise, usually to complement its portfolio of related companies
- A **financial** investor[41] (such as a venture capital fund) might invest in order to grow the value of the company before selling its stake at an increased value

[40] Assuming that change is desired and the current 100% ownership is not an option.
[41] We assume that financial investors will incentivise the management with an equity stake but that (unlike in the management investment case) the management does not pay in cash for this stake.

- The management might invest in the company using either their own personal wealth or by raising debt, typically secured on personal assets (a management buy-out or **MBO**)

In theory, these two dimensions allow for consideration of nine strategic options. From the perspective of the investors, however, not all of the options theoretically available to Scottish Enterprise are attractive. Those options that are clearly unattractive to investors should be ruled out. In the following table we show our assessment of the nine options from the perspective of each type of investor.

		Scottish Enterprise Ownership		
		0%	**Minority**	**Majority**
Investor Type	**Trade**	✓ Preferred model for trade buyers	✓ Possible model, provided trade investor has executive control and SE's stake is maintained only as a financial investment	✘ Very unlikely, trade investors will not want public sector control of operations
	Financial	✓ Preferred model for investors since all of the equity owners then have commercial aims	✓ Possible model, provided financial investors have executive control and SE's stake is maintained only as a financial investment	? Unlikely, since financial investors normally want full control and minority stake would only be tolerated for an exceptional opportunity
	MBO	✓ Likely preferred model for management team	✓ Possible model, provided management team has executive control	✘ Management normally invests to take control since it is putting personal assets on the line

As shown we consider that maintaining a majority ownership by Scottish Enterprise would be unacceptable to both trade and management investors, and in most cases would be unacceptable to financial investors.

Next we consider the remaining options from the likely perspective of Scottish Enterprise. Our assessment is shown in the following table.

		Scottish Enterprise Ownership		
		0%	**Minority**	**Majority**
Investor Type	**Trade**	✓ It is possible to envisage an outcome where SE sells Optocap at a market value to any of these investors, yet reduces the cash price by agreeing for a set number / value of EDP projects to be conducted by the company over a number of years.	✘ Since SE could achieve its EDP objectives by outright sale allied to an EDP rebate (see left), these options do not seem to provide any benefits to SE whilst leaving it with potential liabilities in a company it does not control	
	Financial			✓ Attractive for SE since SE financial burden is reduced whilst it retains control of OL in order to ensure delivery of EDP
	MBO			

There are therefore four remaining valid options. At this stage we can overlay the options for financial investors with our own knowledge of what financial investors generally look for in a company, and with specific feedback obtained from the private equity community on the Optocap opportunity. The details of these two assessments can be found in Appendix F.

From our wide experience of supporting due diligence assignments it is clear to us that Optocap Limited has some serious shortcomings from the perspective of a financial investor. The key issues are:

- Optocap has no specific IP to deploy since its R&D programme was cut in order to reduce the project cost
- Target markets are either stagnant (telecom) or early stage (MEMS, biochip) whereas investors are looking now for investments with high growth potential but low market risk

We have talked to investment executives at two major investment companies in the UK and our interviewees had direct experience of managing investments in start-ups in the optoelectronic sector. They did not show any interest at all in the Optocap opportunity, and gave the following reasons:

- Optoelectronics is currently viewed as an unattractive market by the private equity community
- Optoelectronic packaging is not regarded as being scalable
- The Optocap business model, based on fees for service with some potential upside from deferred payments or equity investments, is not attractive

We conclude that financial investors can be discounted as regards providing an exit route. This leaves us with only two remaining strategic options as shown in the table below.

		Scottish Enterprise Ownership		
		0%	Minority	Majority
Investor Type	Trade	✓	✗	✗
	Financial	✗	✗	✗
	MBO	✓	✗	✗

We will now look at these two remaining basic options in turn.

a Trade Buyer

At least one trade buyer has shown interest in Optocap Limited[42], so this is a live option. Selling outright to a trade buyer would only make sense if Scottish Enterprise could ensure that future EDP are supported. Whether a trade buyer would agree to continue to support EDP, either on the basis of a discounted buying price or guaranteed future revenue would be dependent on the particular company and its intentions for Optocap. These intentions cannot be pre-judged but it is possible that such a deal may be reached.

Ownership by a trade buyer could be a double-edged sword. On the one hand such ownership might provide the financial stability and potential long-term future sought by the Optocap management team. On the other hand the trade buyer may close its new unit ('Newco') depending on trading conditions in the future, irrespective of any EDP agreement between Scottish Enterprise and Newco.

b Management Buy Out

An MBO would be the preferred outcome for the management team. It would also be attractive for Scottish Enterprise in the sense that Newco might more easily be persuaded to support EDP if owned by the management team than by a trade buyer. The main issue with an MBO is that raising the funding in cash to buy out Scottish Enterprise may prove an insuperable hurdle for the current management team.

An alternative to offering the total value in cash would be for the management team to pay for part, or all, of the value in sweat equity. The basic concept is that

[42] Interview with Neil Francis

Scottish Enterprise would transfer the company to management for a nominal fee and Newco would then support future EDP up to the fair value of the company at transfer. Potential pitfalls with this concept include:

- Newco would have to cover 100% of its costs from commercial revenue, so that EDP projects may not get the attention that they require despite the contractual obligations
- If Newco does support EDP fully, then Newco's profitability may be severely impacted with the consequent risk of insolvency

5.3 Preferred Exit Option

From the above discussion there is clearly no ideal exit for Scottish Enterprise. The following table summarises the position for the remaining detailed options for the trade sale and MBO opportunities.

Option	Advantages	Disadvantages
100% sale to trade buyer with reduced price to reflect future EDP support	• Potential increased job security for staff • Trade buyer will have financial resources to support Newco in the future • Scottish Enterprise may get back some of its grant subsidy in cash	• Support for EDP may disappear beyond tie-in period • Trade buyer may close Newco in future • Trade buyer will not support commercial projects of direct competitors, and may prefer not to support external commercial work at all
100% sale to management for cash	• Newco likely to want to support EDP on a commercial basis • Scottish Enterprise gets back some of its grant subsidy in cash	• Management unwilling to raise cash • Newco may find better business opportunities to pursue than EDP
100% sale to management by sweat equity	• Preferred way forward of the management team • Newco may still support EDP on a commercial basis after sweat equity deal is completed	• EDP support may be poor or may impact company viability • Scottish Enterprise will not get any cash return from its grant

We cannot see a practical way forward that would allow the sale to management by sweat equity to succeed. Newco can only be viable by this route if it covers all of its costs by commercial work, but if it does this then it will have very limited capacity, if any, to support EDP.

We therefore conclude that the only potentially executable exit option for Scottish Enterprise is to look for a trade buyer for Optocap Limited. A trade buyer can take a wider view of the potential value created by Newco in its related companies and does not necessarily require external revenues from packaging projects to justify the investment. Whether Scottish Enterprise will actually find a trade buyer that will agree to an EDP tie-in, however, can only be tested by advertising the possibility of such a sale.

5.4 Targets to support preferred exit option

In working towards an exit, Scottish Enterprise should be looking to maximise the value of Optocap Limited. The most critical issue to focus on is the total revenue, which we define here as being the total of commercial revenue and EDP revenue. Where EDP payments are deferred under the current arrangements we also count these revenues as contributing towards total revenue (as defined here) at the time that the projects are executed. The total revenue is therefore an artificial construct that allows us to consider how far Optocap Limited is potentially covering all of its costs going forward, assuming that Scottish Enterprise will continue to support EDP.

We ignore any potential uplift from deferred payments in our analysis, since the probability of achieving these is small (~10%). We also assume that no repayments will be due to the ERDF for missing EDP targets in the first three years of operation.

We assume that the target for EDP for Scottish Enterprise after exit will be 2 per year and that these will be worth on average £187,000 each – this is the average of the three EDP contracts signed to date. The EDP revenue per year after exit is therefore assumed to be £374,000. We have assumed 2 projects per year, rather than 3, post-exit so that Newco is not spending too high a proportion of its time on EDP.

We take the required revenue in the year before exit to be the total operating costs per year, including continuing capital investment and commercial / EDP project consumables, plus an operating profit of 10%. The operating costs for the year to March 2006 are predicted[43] to be £880,000 with modest capex of £104,000 compared to depreciation of £361,000. We assume that a replacement / update capex of £250k per year will actually be needed to sustain the competitive edge of Optocap. We further assume that marketing and project consumable spend will scale approximately with the total revenue.

[43] Management accounts for October 2005 from David Ruxton

With these assumptions a rough[44] summary of revenues, costs and required grant support is provided in the following table.

Year	2006-07	2007-08	2008-09
Required revenues (£)	1,090,000	1,250,000	1,250,000
Total revenues:	1,062,000	1,300,000	1,300,000
EDP revenues	*562,000*	*562,000*	*374,000*
Commercial revenues	*500,000*	*738,000*	*926,000*
Grant funding	590,000	387,000	199,000

The total revenues exceed the required revenues in two of the three years in order that the total grant funding meets the constraint of being ~£1,173,000 over the three years shown (see earlier section on grant payments to date). In practice this means that the theoretical operating profit is higher than 10% in these two years.

In developing these rough-cut financials we have implicitly assumed that Scottish Enterprise will prefer to operate Optocap Limited for as long as possible under the existing grant in order to execute as many EDP as possible. An EDP tie-in with a future trade buyer will then potentially extend further the support of EDP to perhaps 2010 or 2011. There are some potential drawbacks with such an approach that can be identified even at this stage:

- By focussing more on commercial revenues over the period 2006-09 it is conceivable that the skill base at Optocap Limited might change in ways that make it less attractive to potential buyers than now.
- If Optocap Limited becomes more involved with other public sector activities (e.g. the DTI MNT packaging centre) over the next few years then it may make exit more difficult to achieve whilst satisfying other public sector stakeholders.

Whilst more detailed modelling and more robust assumptions are needed, the figures shown above demonstrate the magnitude of the improvement needed on the commercial side in order to prepare Optocap for exit on this timescale. The commercial target of £300k for the year to June 2005 can be seen to be far too modest if Optocap is to operate as a proper commercial company.

5.5 Commercial revenue opportunities

Clearly Optocap will need to make a step change in its approach to commercial work in order to increase its revenues so much. The basic options that it has to do this are:

[44] Included for illustration only, to show the indicative level of targets needed for commercial income and the resultant grant implications. It was agreed that detailed financial assessment is outwith the scope of the current assessment.

- Expand geographically outside of the Scottish community (something that it has done to a limited extent, but in an ad-hoc way)
- Expand its offerings to cover other technical areas and services
- Offer to produce increased volumes for customers
- Increase prices

We consider the first priority should be to expand the geography in which Optocap is known by a concerted marketing campaign, since our interviews indicate that it is not known widely even in England.

The other basic strategy that will enable Optocap to cover its fixed costs better is to engage in higher volume production. The company currently has a fixed view that its business model is to be a prototype house. Unfortunately it is not easy to make a good business out of this model in such a technically demanding area, where significant capex is needed on an ongoing basis. As a matter of priority the management should consider how it might occupy the ground for medium volume production. One of our interviewees indicated that, in his opinion, such opportunities were available in the optoelectronics sector and they are certainly available in the microelectronics[45] sector. In exploring these areas the alternative technologies and services (e.g. supply chain management) that might be needed would be considered simultaneously.

We also consider that there is scope for Optocap to test whether its current pricing strategy is optimal. Feedback from customers was, in our view, rather too positive about pricing and indicated that there is most likely scope for price increases. The management needs to move away from a cost-plus model towards more value pricing of commercial projects, particularly for local customers where the switching costs to alternative suppliers are high.

[45] Optocap may need to add additional capabilities, e.g. PCB layout, but these could be offered via a virtual network to keep fixed costs to a minimum

6 CONCLUSIONS

Our extensive evaluation exercise reveals that overall the Optocap Project and its delivery organisation Optocap Ltd. represent a positive contribution to the health of the Scottish optoelectronics sector and to Scottish Enterprise's approach to delivering Smart, Successful Scotland economic development projects. Customer feedback is universally strong and there are a number of examples of government best practice in the project inception and implementation stages. Clearly, the successful parts of the Optocap process need to be captured and repeated in future projects as a basis for enhancing the economic development activities in Scotland. However, there are also some areas where continuous improvements and new techniques are needed to increase the speed, quality and value delivered by this type of initiative. Our conclusion to this work is therefore to recommend actions to build an even better future for Scottish Enterprise's economic development projects. These improvements are categorised as Inception, Operation and Exit actions.

6.1 Inception

When SE/SEEL establish future projects of this kind they will be able to deliver enhanced outcomes by formally adopting the successful approaches taken within the Optocap Project and by implementing the additional improvements identified during the evaluation. It is acknowledged that the new SE Project Lifecycle procedures should deliver some of the recommended improvements. Sections 3.3 to 4.3 of the report detail all the possible approaches and improvements, but in conclusion the priority actions that we recommend SE/SEEL undertake are as follows;

- Refine, capture and implement a faster, more efficient project phase gate process. (Now part of SE Project Lifecycle procedures)
- Appoint a Director to lead each project concept and to mentor the project leader as he/she manages the project through the phase gate process using a formal project plan. (Now part of SE Project Lifecycle procedures)
- Set up authorisation procedures between SE/SEEL Board meetings
- Use SMART definitions to tighten up target setting, (Now part of SE Project Lifecycle procedures)
- Repeat the detailed scoping of demand used in the Optocap project but with inclusion of rigorous third party due diligence assessment.
- Improved analysis and documentation of market failure and state aid position
- Exploration of alternative methods of supply of the benefits.
- Maintain use of an externally facilitated peer review workshop to focus project and identify risks.
- Maintain quality of Optocap risk register in future projects.

- Improve assessment of economic benefits.
- Develop improved financial modeling of exit strategy.
- Make an early choice of ownership model

6.2 Operation

The general operation of Optocap Limited is assessed as being good with the benefits of a particularly well selected and balanced team. Consultation with stakeholders and customers indicate general satisfaction with the performance of Optocap Limited, for both EDP and commercial projects. In terms of delivery against the project targets Optocap Ltd is being affected by the market changes in the sector. Having successfully gone through the start-up phase and adapting to the market changes it is crucially important that the company now increases its operational efficiency as well as EDP and commercial performance to ensure its sustainability. The highest priority changes to deliver the next steps required in Optocap's development are summarised as follows;

- Greatly increase commercial targets and increase the marketing to meet these needs.
- Broaden marketing to new sectors, (e.g. MNT, MEMS and Biotechnology).
- Change the board structure and membership to improve the commercial/entrepreneurial representation.
- Revise EDP targets to 6 at end of three years to reflect market demand and pipeline.
- Ensure facilities are fully appropriate to market needs (e.g. cleanrooms).
- Continue to use dual role of Project Manager and Board member.
- Reduce operational contact with Optocap Project manager.
- Continue to improve financial controls.
- Introduce time booking system to improve project costing and management.
- Improve staff appraisal & training to deliver continuous performance improvement.
- For future start up companies ensure the CEO has a Director role to increase attractiveness for high performance business leaders.

6.3 Exit

In approving and setting up the Optocap project Scottish Enterprise has a strategic ambition to sell Optocap Limited as a sustainable and commercial asset for the Scottish economy. Ideally, this will remove SE's risks and financial exposure whilst maintaining the Scottish sector supply chain and the availability of an EDP delivery organisation. Our research has shown that the exit strategy options are limited, but to deliver its goals SE should prioritise on the following actions to improve company value and deliver a viable exit;

- Pursue a trade buyer now
- Consider higher volume production
- Put prices up

APPENDIX A INCEPTION LESSONS FROM PRIVATE SECTOR

During the evaluation the team's experience in the private sector in both large and small companies identified a number of issues where lessons could be learnt to improve the inception of the Optocap Project and the delivery company Optocap Ltd. The following tables identify the issues, the private sector expectations and the recommended changes that should take to meet the private sector best practice goals. These recommendations have relevance to both the existing project and any similar class of interventions that SE may take in the future.

A.1 Due Diligence

Expectation of Private Investor	Reality in Optocap Project	Potential Improvements
Extended investigation of technology / IP, market and management team.	• Demand from universities and industry assessed by means of an extensive interview programme by SOA Services. • No team in place at all.	• None, the intention behind this was exemplary in terms of scoping the opportunity. • None, the nature of the intervention meant that no ready-made team was available.
Third-party evaluation of business plan.	• PWC involved in further elaboration of business plan based on SOA Services data, but no independent assessment of specific opportunities identified. The real prospects for a number of the university projects was exaggerated.	• Due diligence by external organisation on PWC business plan, or in-depth checks by PWC on SOA Services' data.

A.2 Management Targets

Expectation of Private Investor	Reality in Optocap Project	Potential Improvements
Will set specific, time-bound targets for key milestones of the business; usually includes technical & commercial targets	• Initial targets related only to 9 EDP projects in 3 years. • August 2005 targets are more specific, include revenue, and have clear timing	• Target setting is now appropriate for the business but being more specific in June 2003 would have represented best practice
Expects team to deliver, or serious implications for the team and / or funding	• Funding may not continue even if EDP targets are met	• Ideally, there would be a commitment at the outset to continued funding if EDP targets are met, so that the future is clear for Optocap & customers. However, it is not possible to provide this commitment beyond the grant period in the public sector.

A.3 Board of Directors

Expectation of Private Investor	Reality in Optocap Project	Potential Improvements
Representation by owners on board	• SEEL staff member is a Director of Optocap Ltd and also runs the Optocap Project. • Scottish Enterprise has control of the Board, and the Chairman.	• None, from a private investor perspective this is best practice (the issue with this dual role relates to public sector governance) •
Regular, typically monthly, meetings between owner board member and management team to provide general advice	• Monthly board meetings • Project manager also has weekly meetings with David Ruxton whilst allowing him to manage the business	• None, this is best practice in the private sector. • Weekly meetings are excessive • More strategic, less regular meetings (perhaps quarterly) since monthly Board meetings already take place
Balance of board provides network to customers and financial investors	• Only Chris Gracie (SOA) is a true external voice on the Board. • Advisory Committee has wider representation from industry but meets occasionally and is unpaid.	• Allocate funding to pay proper retainer to respected industrialist (of calibre of Andrew Rickman)
CEO is member of Board to increase personal responsibility for legality of company operations and performance	• David Ruxton is only Company Secretary, Scottish Enterprise declined in 2003 to give Board membership to CEO position	• Offering the increased power associated with a Board position helps to ensure top-class candidates for CEO position.

A.4 Management Incentives

Expectation of Private Investor	Reality in Optocap Project	Potential Improvements
Stock ownership is the main form of potential reward, helping to align the objectives of the investors and the management	• Moderate industrial salaries with small bonus upside; no equity stake for management	• Management could be granted stock at inception, or as bonuses, in order to increase focus on real value creation and exit strategy

A.5 State Aids

Current Status

Scottish Enterprise has issued various pieces of guidance regarding the tests for State Aid[46] [47]. Assistance is State Aid if the following five criteria are met;

1. The funding is supplied from state resources (e.g. SE)
2. The funding confers an advantage (e.g. loan, grant, relief from charges etc)
3. The funding is selective (i.e. restricted by location, sector, type of business)
4. The funding has the potential to distort competition.
5. The funding has an effect on trade between member states

The project or programme (the "intervention") is to be tested against each of the 5 criteria noted. As a result of the test, interventions are judged to be "Not State Aid" or "State Aid". If the latter, State Aid can be legal or illegal. If judged illegal, consideration can be given to notifying the intervention to the EU Competition Directorate (DG XVI) in Brussels.

It seems clear that conditions 1, 2 and 3 apply in the case of Optocap Ltd. It is receiving state funding from SEEL, there is a financial advantage gained from the assistance, and in this case the funding is selective – granted to Optocap in particular, and is not generally available to all businesses (in the way that a capital equipment tax relief scheme might be, for instance).

[46] State Aid *Briefing Note for Use when Considering Providing Financial Support or Assistance to Companies or Other Businesses*, Scottish Enterprise, Dec 2004.
[47] State Aid – Scottish Enterprise Legal PowerPoint presentation to SEEL 14 Sept 2005

More attention, however, requires to be directed to the 4th and 5th questions in the State Aid test.

Regarding *distortion of competition*, there is considerable evidence from the Business Plan and from prior research that there are no competitors providing these services in Scotland, and none has emerged in the lifetime of Optocap. There is therefore no competitive market to be "distorted". This appears to be true of (a) university project development, and (b) the specific commercial services offered to the optoelectronics industry in Scotland.

In the Optocap business model, State Aids issues are covered by operating the projects on a contracted commercial basis. When the company provides services to the market, consultancy is charged out at full commercial rates (circa £500/day) charged for the nearest comparable types of technology testing services. Within the UK three potential commercial competitors have started to offer optoelectronic packaging services, namely; Entroptix in Plymouth Devon, the Centre for Integrated Photonics (CIP) in Martlesham Heath, Ipswich, Suffolk and SIFAM Fibre Optics in Torquay South Devon. However, as long as Optocap continues to charge its services at commercial rates it will satisfy the state aids rules within the UK.

Concerning the final question about having an *effect on trade* between EU member states, the Optocap assistance can be considered a local intervention, with its customers primarily local to Scotland. During the client interviews there were no examples of European competitors outside the UK, suggesting that there is no intra-EU trade disruption by the Optocap project. Indeed, outside the UK the only optoelectronic packaging service provider mentioned was US based EM4 Inc.

It is noted that European Union ERDF funding was used in the project, although this in itself does not remove the obligation to pass the State Aid tests.

The Chief Executive shows a ready awareness of State Aids issues in regard to the project.

Legal advice on State Aids was stated to have been taken from legal firm Burness. The State Aids Unit at Scottish Executive appears not to have been consulted, but this is not mandatory, and the project owner retains responsibility for any decisions re notification to the EU.

Conclusion

The above analysis of the state aid rules and the evaluation of the project performance and the competitor position reveal no clear distortion of competition and no effect on trade between Member States of the EU. It is therefore concluded that the State Aid, which is undoubtedly present in this project funding, is legal.

APPENDIX B SUGGESTED INITIALISATION PROCESS

There is a broad policy cycle operated by a range of government departments and agencies throughout the UK that is commonly known as ROAMEF. This approach has been operated for over a decade and it is a proven top level approach to government creating, delivering and measuring initiatives. The Treasury Green Book recognises this as a best practice strategy.

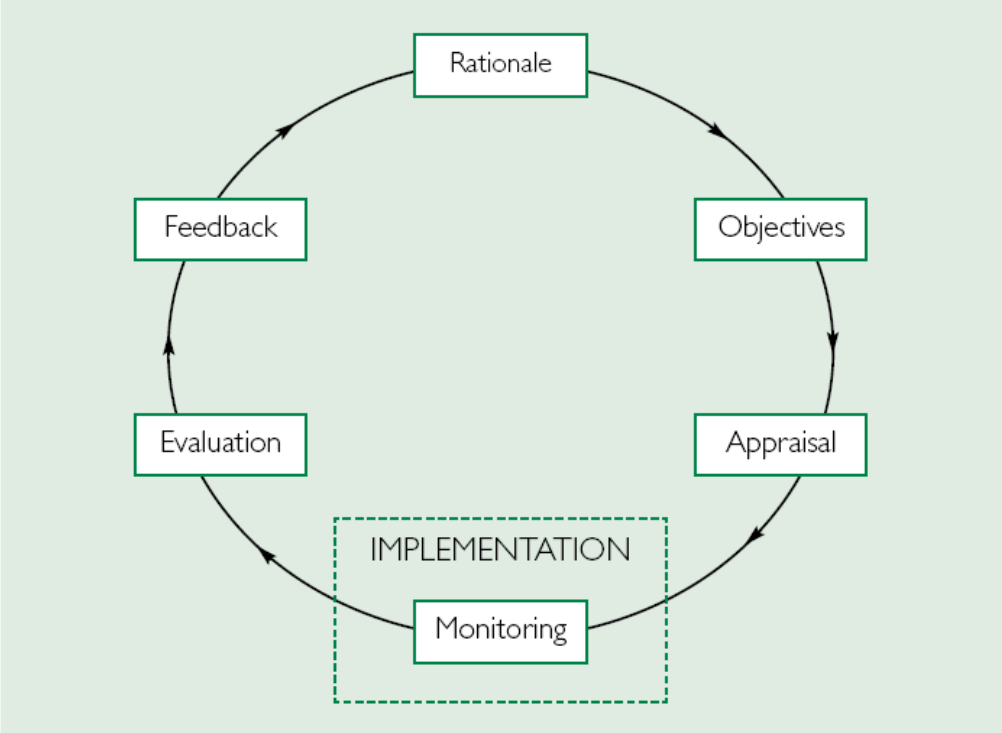


Figure B.1 ROAMEF Government Intervention Cycle

The project initialisation phase is covered by the Rationale, Objectives and Appraisal processes and the challenge for Scottish Enterprise is how best to create, manage and complete future projects. The Optocap project is an example of a positive intervention that went through these top-level stages, but the operations took far too long and displayed a mixture of best and mediocre practices. Our research has shown that during 2005 SE developed a gateway and product lifecycle process that is aimed at delivering a faster, higher quality project creation process. Early feedback from SEEL staff suggests that the early implementation of the new gateway process will deliver a much faster project inception and implementation performance. However, given that the national SE internal guidance for these new processes only took place in October 2005 it is far too early to carry out a real evaluation of the new project lifecycle implementation. The remainder of this Appendix describes a phase gate process model based on the Generics model for comparison with the new SE process.

Generics have been going through the process of generating ideas, testing project feasibility and then creating companies for nearly 20 years. By monitoring and evaluating these activities the company has built and refined a successful process entitled the Generics Investment Engine. (See Figure B.2) This is essentially a team working based phased gate process that has already delivered over 50 start-up companies.

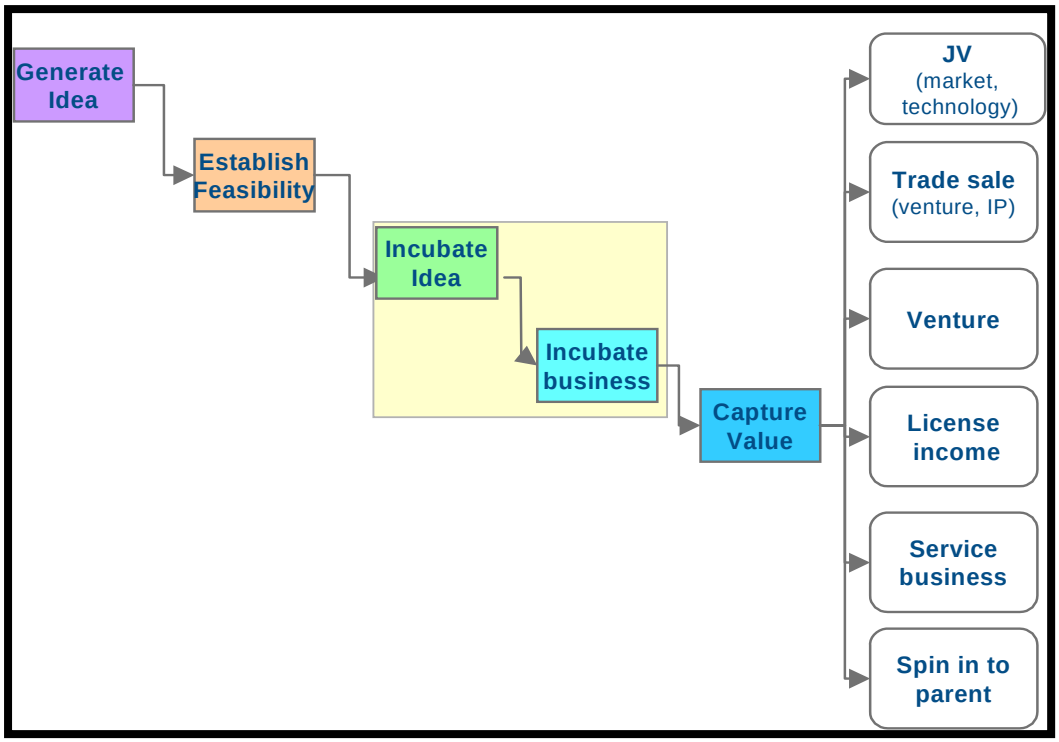


Figure B.2 Outline of the Generics Investment Engine

It is proposed that this proven technique is used as a baseline comparison model for the SE process. By using the Generics Investment Engine process in the context of the ROAMEF model, the SE/SEEL Optocap project performances and The Green Book it is possible to build a strong project model.

Figure B.3 shows a suggested process where examples of duplication are removed and key activities around outputs, risks, sensitivity analysis and governance are moved earlier in the process than current practice. Optocap best practice examples such as action plans, Peer Reviews, risk analysis and the detailed research are included in the process. This process model was built before reviewing the SE Major Gateway process.

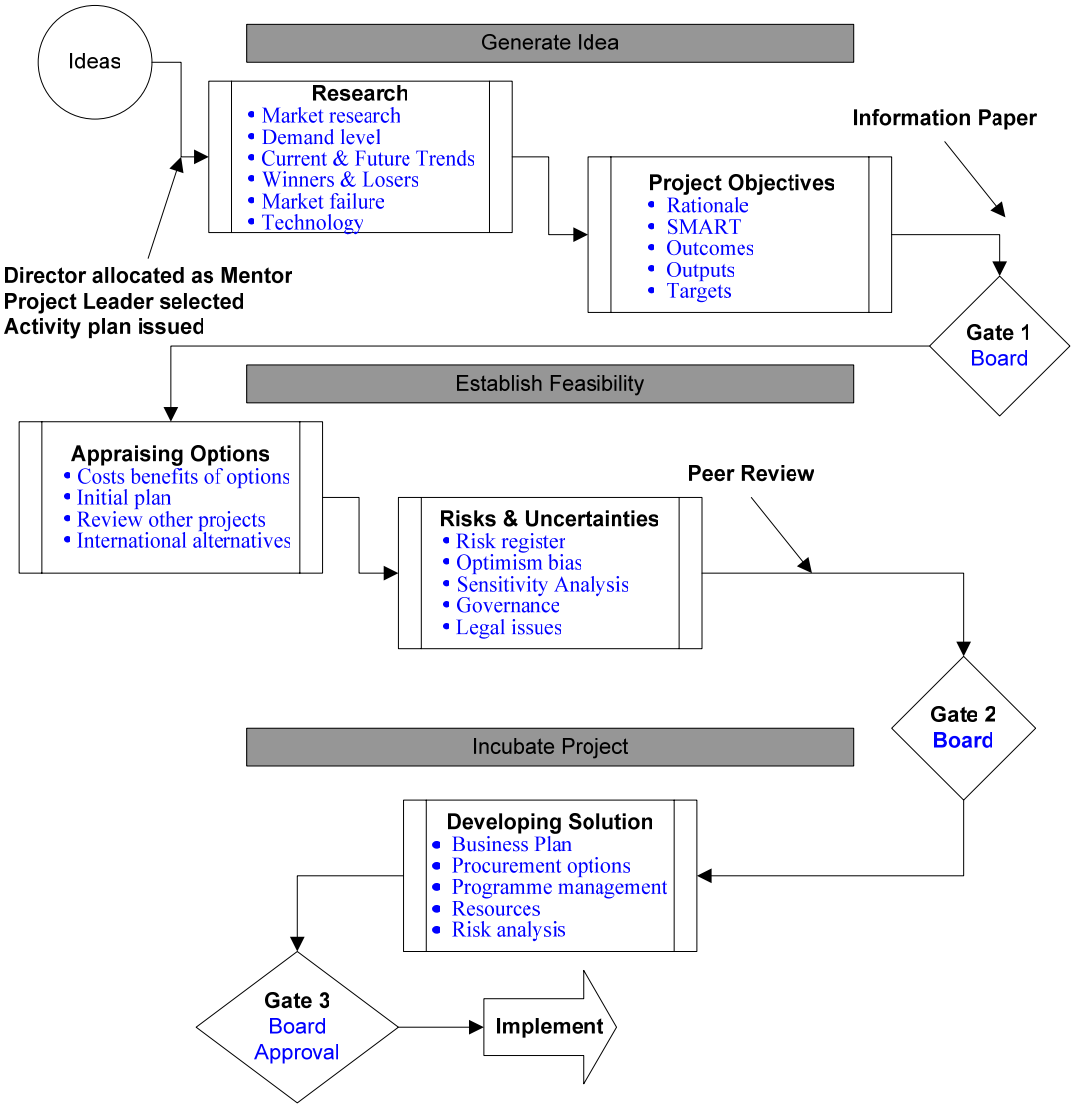


Figure B.3 Proposed Project Initialisation Process

Initial discussions reveal that whilst there are similarities in the overall tasks in both models there are differences in the balance of work between the gate review stages. Figure B4 shows a summary of the SE major gateway process as a comparison with the Generics model.

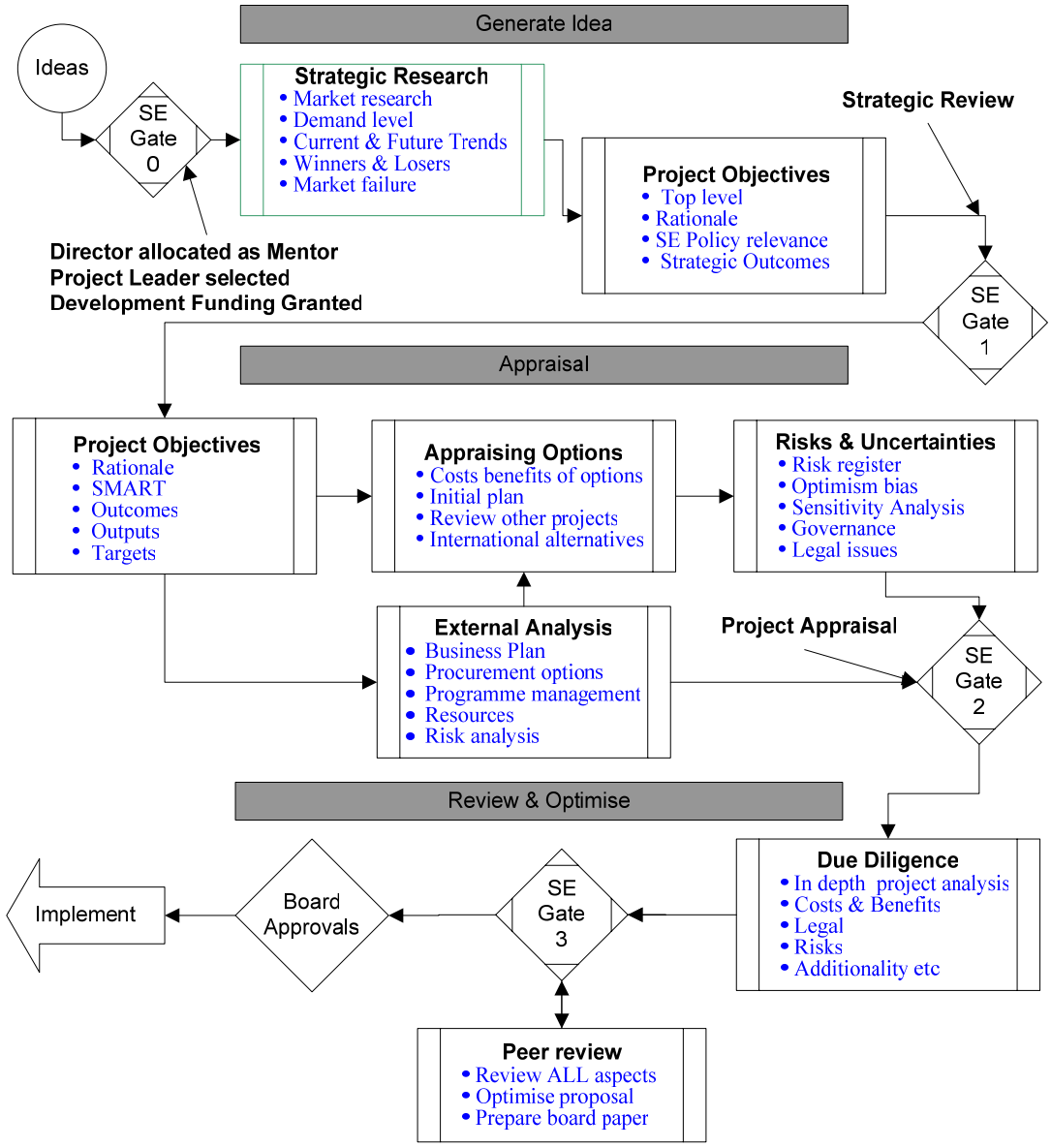


Figure B4 Summary of SE Major Project Gateway Process

The following table shows the stages of these 2 best practice models;

Phase Gate	SE Gateway	Generics Model
Gate 1	Generate Idea	Generate Idea
Gate 2	Project Appraisal	Establish Feasibility
Gate 3	Review & Optimise	Incubate Project.

Both models follow a 3 phase approach but in a different balance of actions.

The new SE approach is to focus on a top level strategic review for the Gate 1 decision. Once a project has been accepted as a strategically desirable project the next phase of appraising the project contains a detailed definition, planning and analysis of the possible project delivery approaches. The final project initialisation phase is to carry out an in depth due diligence and a peer review to optimise the project plan, funding and outcomes ready for the board approvals.

In contrast the Generics model starts with more emphasis on setting up in-depth project objectives to generate the initial project ideas. The second phase is focussed on appraising the project alternatives and the risks in delivering the project. It also proposes the peer review at this earlier stage to ensure that the final project plan is directed towards the agreed group objectives. Thus the final stage has a much greater concentration on developing the final project delivery plan than the equivalent SE phase of due diligence.

APPENDIX C LIST OF INTERVIEWEES

Interviewed or Consulted	Organisation
Mike Sibson	3i
Steve Turley	Bookham Technology Ltd
Chris Hodges	Carlyle Group
Neil Weston	CIP
Neil Martin	CST Global
David Pedder	EPPIC Faraday, TWI
Brendan Casey	Kelvin Nanotechnology Ltd
Patrick Hickey	LUX Biotechnology Ltd.
Ron Laird	Micro Emissive Displays Ltd
Bill Campbell	Micro Emissive Displays Ltd
Jeremy Rice	Optilock Ltd
Dave Ruxton	Optocap Ltd
Bill Ashby	Optocap Ltd
John Goward	Optocap Ltd
John Lynn	Optocap Ltd
Kim Shaw	Optocap Ltd
Chris Gracie	SOA
John Ure	Zinwave Ltd
John McMillan	Scottish Enterprise Legal
Sandra Reid	Scottish Executive - State Aids Unit
Ian Blewett	SEEL
Neil Francis	SEEL
Mike Shiel	SEEL/SFDI
Scott Wilson	SEEL
Dr Lesley Thompson	EPSRC
Dr Emma King	EPSRC
DK Arvind	University of Edinburgh
Melville Anderson	University of Glasgow
Jane Queenan	Heriot Watt University
Andrew Willshire	Strathclyde University E&EE
Prof. Deepak Uttamchandani	Strathclyde University E&EE
Tim Holt	Institute of Photonics
Simon Andrews	Institute of Photonics

APPENDIX D LIST OF DOCUMENTS REVEIWED

1. The Green Book, Appraisal & Evaluation in Central Government, Jan 2003, HM Treasury
2. State Aid *Briefing Note for Use when Considering Providing Financial Support or Assistance to Companies or Other Businesses*, Scottish Enterprise, Dec 2004.
3. State Aid – Scottish Enterprise Legal PowerPoint presentation to SEEL 14 Sept 2005
4. Enterprise & New Towns (Scotland) Act, Scottish Executive 1990
5. Business Gateway Procedures Manual, SE
6. State Aids Guidance Note, SE
7. Scottish Enterprise Projects Lifecycle Procedure & Guidance: Project Initiation Document, version 1.0, SE, 31 Oct 2005.
8. Project Initiation Document (PID) Full Version, v1.0, SE, 31 Oct 05
9. Integrated Electronic Systems in Packaging, Rationale paper, Scott Wilson Scottish Enterprise Network , 2001
10. SEEL Information Industries Encapsulation Centre Report: Peer Review, July 2002, precept Programme Management Ltd.
11. Integrated Optoelectronics Encapsulation Centre, Approval Paper, SEEL Information Industries, December 2002.
12. OPC Business *Plan Final Report*, Price Warehouse Coopers, September 2002,
13. Certificate of Incorporation, Optocap Ltd. 25th February 2003
14. Memorandum of Association of Optocap Ltd. 25th February 2003
15. Articles of Association of Optocap Ltd. 25th February 2003
16. Executive Service Agreement Between Optocap Ltd and Dave Ruxton, June 2003
17. Certificate of Assurance, Internal Control Checklist 2004-05, Scottish Enterprise
18. Optocap Ltd Business Plan Brief, 3rd March 2003,
19. Optocap Ltd Business Plan Revision 2 August 2004,
20. Scottish University Technology Opportunities, August 2002, SOA Services Ltd.
21. Optocap CEO Infopack, March 2003, SEEL
22. Optocap Limited Board Meeting minutes, 30 August 2004.
23. Optocap Limited Board Meeting minutes, 18th January 2005
24. Optocap Limited Board Meeting minutes, 25th February 2005
25. Optocap Limited Board Meeting minutes, 21st April 2005
26. Optocap Limited Board Meeting minutes, 19th May 2005
27. Optocap Limited Board Meeting minutes, 21st June 2005
28. Optocap Limited Board Meeting minutes, 1st August 2005
29. Optocap Limited Board Meeting.Minutes, September 2005.
30. Optocap Board Agenda, Oct 2005
31. Optocap Report and Financial Statement 2005, Draft
32. Management accounts for October 2005

33. Document Data Control,Document Generation Procedure, 250-000-00, Optocap Ltd
34. Quality Assurance Document, Document Change Request Form, 250-002-001, Optocap Ltd.
35. SAGE Accounts procedure, 250-003-001, Optocap Ltd
36. Purchase Order procedure, 250-005-001, Optocap Ltd.
37. Project Management Procedure, 250-015-00, Optocap Ltd.
38. Quotation Template and Use Therof, 250-019-001, Optocap Ltd.
39. Authorisation of Bank Payments, 250-020-00, Optocap Ltd.
40. Optocap Funding Guidance, 250-021-00, Optocap Ltd.
41. SEEL Scottish Packaging Centre Model, March 2002, SOA Services Ltd.
42. Packaging Technical Programme, August 2002, SOA Services Ltd.
43. Staged Capabilities Plan, August 2002, SOA Services Ltd.
44. Scottish Optoelectronics Packaging Centre, July 2002, SOA Services Ltd.
45. Commercial Technology Opportunities, August 2002, SOA Services Ltd.
46. Facilities Requirements., August 2002, SOA Services Ltd.
47. OPC Risk Analysis, August 2002, SOA Services Ltd.
48. Staged Capabilities Plan, August 2002, SOA Services Ltd.
49. Technical Recruitment, August 2002, SOA Services Ltd.
50. Technology Route Map, August 2002, SOA Services Ltd.
51. Operational Cost Projections, August 2002, SOA Services Ltd.
52. Development programme for an Opto-electronic packaging centre, August 2002, SOA Services Ltd.
53. Project Cost Breakdown, Explanation of method, August 2002, SOA Services Ltd.
54. Quantified Revenue Streams, August 2002, SOA Services Ltd
55. Working model and development programme for a Scottish packaging centre, March 2002, SOA.

APPENDIX E MARKET STATUS

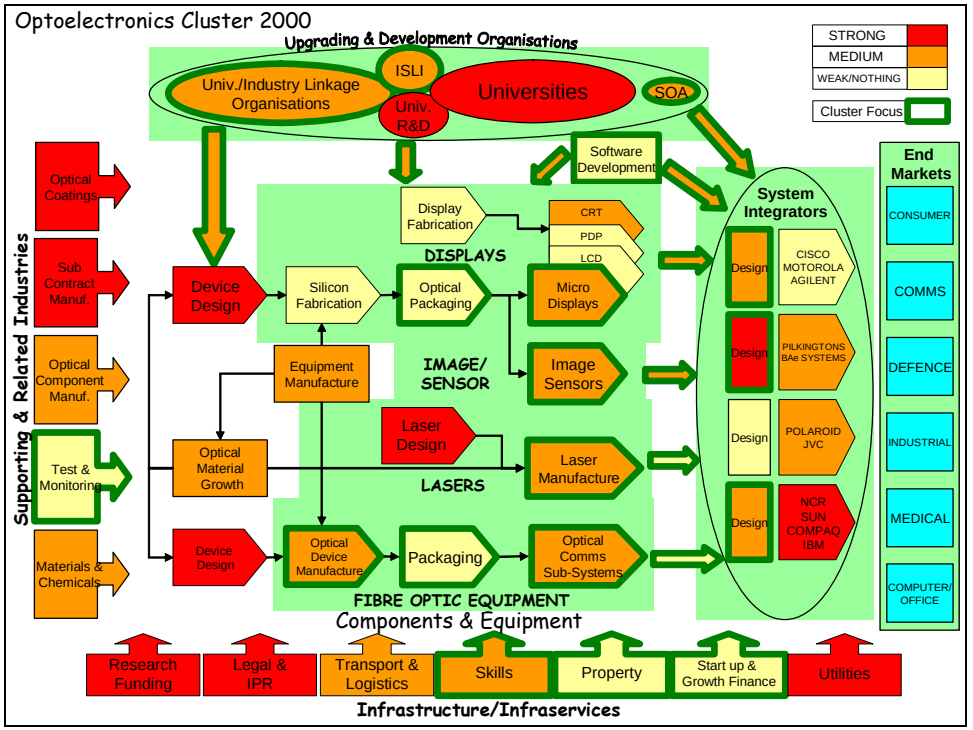
E 1 The market in the late 1990's

In the late years of the 1990's, there was tremendous optimism about the future of telecoms based around optical technologies. Optoelectronics was hailed as the enabling technology that would delivery vast amounts of data at high-speed to consumers across the globe. Growth forecasts were dramatic and all those who invested in this sector wanted to ride the wave and kept looking for new technologies that would sustain this growth and prosperity. New technologies were hailed as "disruptive" and universities were encouraged to support this wave of technology; this was most often done through the creation of spin-out companies or through licensing opportunities with major companies.

Scotland was part of this optimistic world. Scottish Enterprise saw the opto-electronics industry as being a core element in their cluster theory for regional economic growth[48] and they developed a technology road map for the cluster to inform the Scottish strategy. The roadmaps were summarised in two PowerPoint cluster maps that showed the components within the cluster to enable opto-electronics technology to develop into products in a way that would benefit Scotland. The maps were derived from analysis of Scotland's position in 2000 and the intended position in 2010.

[48] The discussion document for the Scottish Optoelectronics Packaging Centre (July 2002) observed: Scotland already has a substantial base level of optoelectronics activity ranging from academic research within 11 Universities to development of components across around 86 companies (which in turn range from start-ups to established corporates).

Strengths and weaknesses were colour-coded as can be seen in the roadmap reproduced below.



In 2000, packaging (both optical packaging and device packaging) was seen as a weakness that might be a barrier to success in reaching the end markets. This was converted into a strategic objective leading to the Optocap project.

The Scottish Optoelectronics Association identified 86 opto-electronic companies that supported the Optocap initiative; of these, 19 were specified as Optocap leads. The distinction between a commercial lead and an EDP was not seen as significant and the targets that were set were based on assumptions about the rate of support.

Research undertaken by Generics in 2003 suggested that EPSRC funding into optoelectronics that might require services from a venture such as Optocap might amount to £750k per annum. This was outside block funding that EPSRC made available to certain centres of excellence. Competition for all such EPSRC funding was fierce and there were many candidate organisations (Southampton, in particular, had a very strong position). This sector support was encouraged by the rate of spin-outs from universities with their optoelectronic technologies.

E.1 The optoelectronics world in 2005

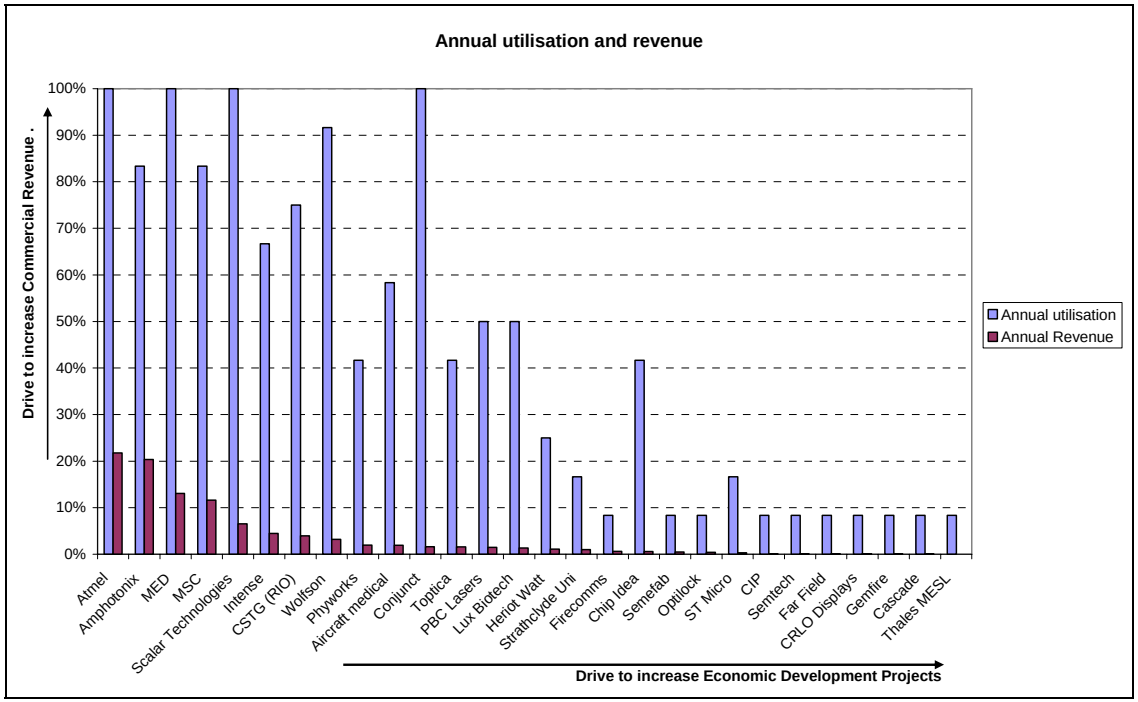
Data for the UK's strength in optoelectronics is difficult to obtain with any accuracy; there are no authoritative sources of information. One useful source is the DTI which produces guides to the UK capability in this sector. This gives a comforting, but deceptive, sense of how little this sector has changed.

	2001	2003	2005
Universities	26	25	20
Companies	100	104	106

The DTI guide does not give a clear indication of types of company so there is a mixture of organisations ranging from distribution companies to multi-national defence organisations. This can lead to the conclusion that there is a good base of companies across the UK where Optocap might be able to gain business. Furthermore, one might conclude that the position has changed little since the SOA assessment of 86 optoelectronic companies of which 19 were specified as Optocap leads.

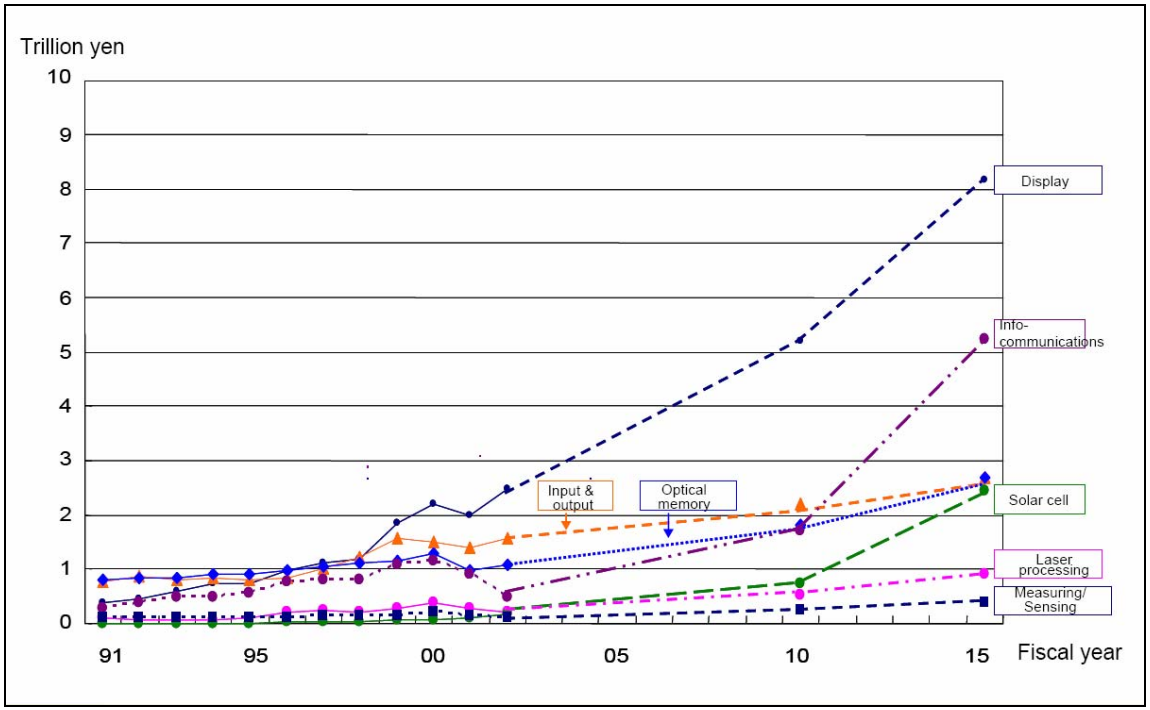
Reading through the list shows that there has been a significant change in the UK scene. Companies such as JDS Uniphase have come and gone from the UK; Corning has closed many of its facilities; companies such as Blaze Photonics and Kymata have changed hands and are now foreign-owned; Bookham has evolved and rationalised and is still doing so; and the investor community is more wary than it used to be. This is reflected, in a sense, in the revenues for Optocap.

Optocap's business model puts it in a position where it has to work with two different sets of customers: those bringing in commercial revenues and those requiring support as an Economic Development Project (EDP).



The graph shows the distribution of revenue coming from organisations into Optocap up to September 2005 and forecast to March 2006 over a 12 month period (i.e. from April 2005). Much of the effort seems to be devoted to achieving small revenues in a market that is becoming increasingly difficult because of market trends, discussed below because the world has moved on significantly since Optocap was created, and this is discussed in more detail now.

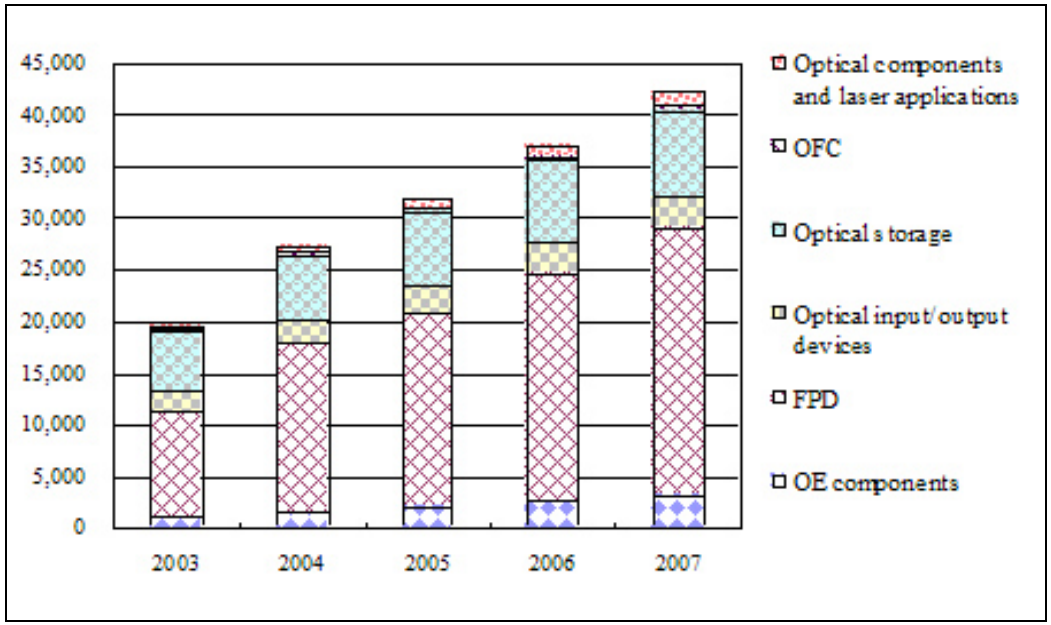
The OITDA estimated, in November 2004, the trend of domestic (Japan) production volume by applications.



(Source: OITDA web site: http://www.oitda.or.jp/)

This graph shows the dip that occurred in the info-communications sector around 2002 and shows an interesting forecast growth from 2010 that is driven by new technologies, discussed later.

Much of the immediate growth clearly comes from the displays sector. The dominance of displays in the opto-electronics market is also shown in Taiwan. The graph below shows the trends of the production value of Taiwan's photonics industry from 2003 to 2007.



(Source: PIDA, 2004 . Units: Millions USD. http://www.pida.org.tw/newversion/homepage/2001new/english/e-index.asp)

Behind these trends, there is a clear shift in focus from optical fibre communications (OFC) to other areas of technology. Three national perspectives are summarised below.

Japan

The OITDA identified those topics of technology that will grow in significance in the coming decade:

- Info-communications field
  - Optical packet switch
  - Optical flip flop
  - Quantum cryptographic communications, etc
- Display/Lighting/Optical memory fields
  - 3-D display
  - Sheet display
  - White LED
  - Molecular memory, etc.
- Environment/Energy/Biotechnology fields
  - Fiber nerve net
  - Photocatalysis
  - Solar power generation
  - Laser nuclear fusion,
  - Optical cancer treatment
  - Optical CT
  - Optical agriculture, etc.
- Nano-photonics/Fundamental technology fields

- Quantum dot
- Photonic crystal
- Nano-optical processing/femto-second laser processing, etc.

(Source: OITDA web site: http://www.oitda.or.jp/)

Korea

The KIPA web site gives a sense of the national R&D objectives in the area of photonics.

Objective of Business	nducing project of product development with making up a cooperative association of enterprise. University. research Institute in order to develop needed technology for industrial conversion and attract relating companies of Photonics industry and supporting for product commercialization of research result.
Field of Business	Optical communication component, laser adaptation implement, new light source, optical material component
Scale of Business	Research and development of 130 project for 4 years in 5 fields
Content of Business	

Although it lists four areas of technology, KIPA refers to five fields for R&D.

(Source: http://www.kapid.org/eng/technology/pku_technology01_RDprogram.jsp)

Taiwan

The Taiwanese industry perspective on this market is relevant to Optocap's business in the commercial world:

As FPD manufacturers establish the 5th generation TFT-LCD production lines, the key competitive advantages of the industry have shifted from technological capability and mass-production to capital-intensive investment mode. In the future, companies in the industry may want to establish their own brand and try to market such brand. In the future, to the photonics industry of Taiwan, the important competitive factors will be technological capability, mass-production, capital and the establishment of a brand name and its marketing.

There have been difficulties, hurdles and challenges in the photonics industry of Taiwan in the past 20 years. These difficulties and challenges included (1) Many companies in the industry jumped on the bandwagon by engaging in the manufacturing of lucrative products, and this prompted the vicious cycle of price-slashing war and the reduction of profit margin; (2) Many companies had to shift their production lines to China because the market reached a saturated level; (3) Many companies had to depend on foreign companies for necessary technologies, key components/assemblies and patents; (4) The global economic condition has been quite sluggish from 2000 till now.

Fortunately, the companies in the industry have been able to overcome or deal with all the adversities and difficulties and generate more income so that Taiwan may become an important country in the global photonics supply chain.

(Source: http://www.pida.org.tw/newversion/homepage/2001new/english/overview.htm)
PIDA: Photonics Industry & Technology Development Association

The photonics technology and its applications include 6 fields/categories:

(1) OE components
(2) FPD
(3) optical input/output devices
(4) optical storage
(5) optical fiber communication (OFC)
(6) optical components and laser applications.

In 2004, the “OE components” field and the “FPD” field registered growths of 26% and 41%, respectively; these two fields have been showing the highest growth in the past few years. In terms of the market share of the global photonics market of 2004, the market value of FPD (including LCD, PDP and OLED and projectors) has been growing steadily and comprises 30% of the global photonics market in 2004.

	2003	2004		2005		2006	2007
	Output Value	Output Value	Growth	Output Value	Growth	Output Value	Growth
OE components	1,102	1,530	39%	1,985	30%	2,500	3,099
FPD	10,144	16,369	61%	18,898	15%	22,302	26,092
Optical input/output devices	1,980	2,120	7%	2,572	21%	2,833	2,928
Optical storage	5,695	6,349	11%	7,182	13%	7,957	8,342
OFC	250	283	13%	332	18%	405	477
Optical components and laser applications	453	645	42%	857	33%	1,100	1,312
Total	**19,625**	**27,297**	**39%**	**31,827**	**17%**	**37,099**	**42,250**

Production Value of Taiwan Photonics Industry
Units: US$ 1 million

(Source: PIDA, 004, http://www.pida.org.tw/newversion/homepage/2001new/english/overview.htm)

Hong Kong

Hong Kong goes into more detail about the technologies it sees as important. Optoelectronics has a very large scope and it can basically be defined and classified by applications in the following categories:

- Optoelectronics Material & Components
  - Panel display components: LCD display components; LED display components; Fluorescent display and Electro-luminescent display components.
  - Optoelectronic components: Luminescent diodes; Special optic plastic and Special optic crystals.
  - Optoelectronic materials: Special optic glass; Special optic plastics and Special optic materials.
- Opto information (Opto information technology) Industries
  - Optical input and output equipment: Picture scanners; Form readers; Character recognizers; Barcode scanners; Digital cameras; Laser printers and Laser fax machines.
  - Optic storage: Equipment CD drives; Optic cartridge drives; Optic storage media: CD, VCD, LD, CD-ROM, MO, DVD.
- Opto Telecommunication
  - Systems and equipment: Fiber optic transmission equipment; Fiber optic area network equipment ; Fiber optic communication detection and monitoring equipment; Fiber optic information engineering equipment; Terminal equipment and Fiber optic CATV systems.
  - Components: Single mode, multi mode fiber couplers, optic attenuators, optic isolators, spectrometers, wavelength-division multiplexers (WDM) etc..
- Lasers and Laser Applications
  - Laser generators: Semiconductor laser generators; CO2 laser generators; Solid laser generators; Gas laser generators; Dye laser generators and Quasi molecule laser generators.
  - Laser application: Laser application in industry; Laser application in medical therapy; Laser application in military; Laser application in science research and other applications.

- Optical Sensor
  - Optical sensors: Optoelectronic sensors; Optoacoustic sensors. Fiber optic sensors and others. As an example, on the Tsing Ma Bridge, an FBG interrogation system is being install on the bridge for strain monitoring.
- Nano-Photonics
  - Photonic devices in the submicro- and nano-scales. e.g. photonic crystal

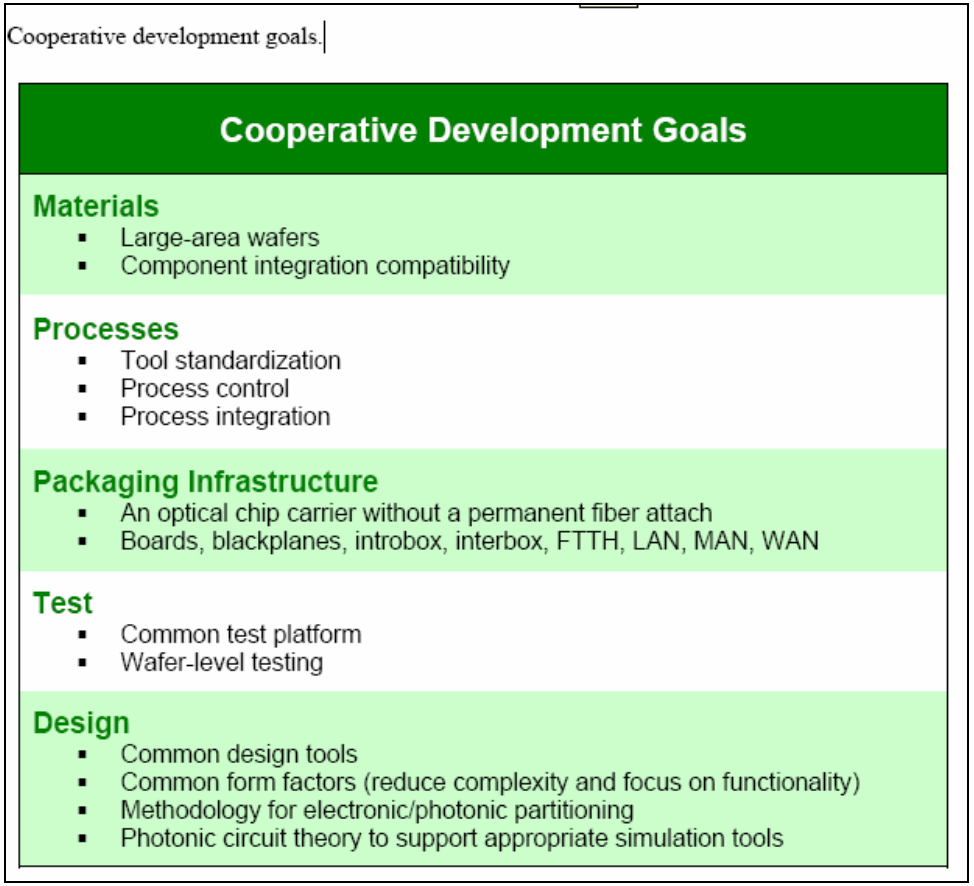
(Source: http://www.hkoea.org/vision_set.htm) – Hong Kong Optoelectronics Association

USA - MIT Roadmap

The US perspective comes from the MIT roadmap that summarises the global position for communications technology.

- Photonic technologies have already revolutionized communication and hold similar potential for imaging, sensing, and computing applications. Anyone who doubts the potential demand from these markets needs look no further than the roadmaps for computing technologies. These roadmaps recognize that although chip-level feature scales will not shrink at rates seen to-date, system performance must continue to grow. This will require parallel architectures that are ultimately limited by interconnect performance. By 2010, the target for high performance machines is for interconnets with 10 petabits/s (1015 bits/s) capacity connecting approximately 100,000 CPU cores.
- Realizing this potential requires a healthy photonics components industry; the market and technology barriers to this health are notable, however. Achieving sustainable product standards, cost reduction through planar integration, and electronic-photonic integration—as well as the common industry infrastructure required for technology research, development, and adoption— represents a set of tasks too great for any one firm.
- To overcome this, the Communications Technology Roadmap program at MIT is currently organizing a set of industry leaders to drive the changes needed by the industry. The goal of this Leadership Council is to guide cooperative research and development that will lead to a virtual, vertically-integrated industry supply chain. The expertise required to accomplish this does not exist at any one company today. Table 2 [*reproduced below*] lists some key issues identified by the CTR program. The role of the Leadership Council and the Microphotonics Center Roadmap program will be to coalesce resources and competency to address these challenges. Ultimately, a roadmap can only identify issues. It is up to the leaders within any industry to ensure that those challenges are met and the opportunities seized.

Cooperative development goals.



One of the key points that comes out of this report is that collaboration is the route forward; it addresses the complexities of managing technology transfer from a laboratory into production. They also emphasise the value of platform technologies which implies a strong belief in the need to simplify technology, a trend that Generics has noted more widely.

EPSRC

EPSRC's research portfolio is determined overwhelmingly by the research community and is delivered through programmes. Thus they respond to programme themes judged to be most significant to the research community. We asked EPSRC if they could give us some data on funding in the optoelectronics sector.

Optoelectronics is a very broad term so EPSRC are cautious about how we might interpret their figures; much research is at a device and material level and is, therefore, some way away from services provided by Optocap. In order to answer our questions on how EPSRC level of funding has changed in optoelectronics since 2000, they looked at the grants funded in 2000 (January to January) compared to 2005 (January to January) – with a strong caveat that the figures are approximate because they do not have a keyword in optoelectronics. They had, therefore, to search for the grants using 'optoelectronics' and may have picked up all the grants with optoelectronics in the title and summary - so the relevance of these grants to optoelectronics may be questioned. They reminded us that our definition of optoelectronics may be different from theirs. With all these caveats, the approximate figures were:

Year	No. of grants	Value	Comment
2000	39	£21 million	includes IRC in ultrafast photonics - £11 million (but not fully an optoelectronics
2005	33	£15 million	includes Electrophotonics Managed call - £2million, 6 grants

Although the number of grants is lower in 2005, the median size of the grants look to be bigger for year 2005.

The UK and Optocap's immediate commercial market opportunities

The position in the UK has changed significantly since Optocap was conceived. This table summarises the postion of many companies that might have turned to Optocap for packaging.

Company Name	Year Est.	Products	Still operating?	Location	Changes since 2001
Bookham Technology	1988	Laser diodes, thin film filters, optical transceivers, EDFA	Yes	England but due to re-list as US company	In 2002 bought the optical components businesses of Marconi and Nortel Networks. In 2003 bought Cierra Photonics of Santa Rosa, California (thin film filters) and Ignis Optics of San Jose, California (optical transceivers). In 2004 bought New Focus, Inc. of San Jose, California. (photonics solutions to non-telecom diversified markets) and most recently acquired Onetta, Inc. (EDFA).
Fibrecore	1993	Specialty optical fibres	Yes	England	
Protodel	1995	Specialty optical fibres	No	England	Receivers appointed in 2002. Assets acquired by Fibrelogix (UK).
Optical Micro Devices Ltd	1999	Opto-electronics foundry	No	England	Went into administration in 2002, just a year after its £15 million purpose-built facility was officially opened.
ilotron	2000	Optical switch	Acquired	England	Assets bought by Ditech in September 2001 for <$1 million after funding ran out.
Kamelian	2000	SOA	No	England	Closed in 2004, products now made on virtual model by CST Global for Amphotonix
Polatis Ltd	2000	Optical switch	Merged	England	Merged with Continuum Photonics, USA in 2005
quantumBEAM	2000	Free-space optical communication	No	England	Went into receivership in May 2003
Southampton Photonics	2000	Fibre lasers	Yes	England	Now called SPI. Refocused its operations as a laser business in January 2003 with move into aerospace and industrial markets.
ZBD	2000	Bistable LCD displays	Yes	England	£2.5 million funding round in 2002

Company Name	Year Est.	Products	Still operating?	Location	Changes since 2001
Blaze Photonics	2001	Photonic bandgap fibres	No	England	Assets acquired by Crystal Fibre in August 2004, company in UK closed down.
Indigo Photonics	2001	Fibre Bragg Gratings	Acquired	England	Acquired by Insensys in July 2003 for its optic fibre sensor capabilities, not telecom FBG as originally envisaged at start-up.
Mesophotonics	2001	Photonic crystal nano-devices (fabless)	Yes	England	Second round financing in 2003.
Intune Technologies (Dublin)	1999	Swept laser systems	Yes	Ireland	Second investment round in 2002.
Eblana Photonics (Dublin)	2001	Source lasers (fabless)	Yes	Ireland	Series B funding in February 2003
Firecomms (Cork)	2001	Resonant cavity LED and visible VCSEL. (fabless)	Yes	Ireland	
Kelvin Nanotechnology	1997	III-V foundry services, specialising in e-beam	Yes	Scotland	
CST (Global)	1998	III-V foundry	Yes	Scotland	CST Global established as company limited by shares, with access to former facilities (now run as Photonix)
Kymata	1998	VOA & AWG	No	Scotland	Bought by Alcatel, then closed by Avanex in 2003 (Avanex in turn bought Alcatel)
Terahertz Photonics	1998	Silicon on silica and polymer planar waveguide materials	No	Scotland	The company's laser coatings division, was sold off and renamed Helia Photonics, raising £1m in September 2002. Terahertz itself called in the receiver in August 2003.
MED	1999	Polymer organic LED displays	Yes	Scotland	AIM flotation in 2004.

Company Name	Year Est.	Products	Still operating?	Location	Changes since 2001
Photonic Materials	1999	Single crystal components	Yes	Scotland	Third round funding in 2004
Intense Photonics	2000	Laser arrays	Yes	Scotland	Shifted focus from telecom to industrial inkjet market
MicroVue	2000	Ferro-electric liquid crystal on silicon microdisplay	Acquired	Scotland	Went into liquidation in December 2003, assets sold to CRL Opto (from which it licensed technology). CRLO Displays was then created with additional financing in 2004.
Accuscene	2001	Ferro-electric liquid crystal on silicon microdisplay	Yes	Scotland	
Essient Photonics	2002	Integrated opto-electronic circuits, EAM	No	Scotland	Went into receivership in 2003
Helia Photonics	2002	Thin film coatings	Yes	Scotland	

E.2 Reference documents

- MIT Microphotonics Center Industry Consortium – Communications Technology Roadmap 2005
- Photonics in the UK – A guide to UK capability, 2005/6 edition. DTI
- Photonics for the 21st Century, Consolidated European Photonics Research Institute, produced by VDI
- Developments in electronic and photonic packaging research and manufacturing – a scoping mission to China, DTI Global Watch, June 2005
- Photonics Metrology Programme, April 2004 – March 2007, DTI National Measurement System
- Interim Report: Status of the Photonics Industry in the UK and Initial Recommendations, DTI Photonics Strategy Group, July 2005
- "Future Vision of the Optoelectronics Industry Toward Further Growth by Evolutionary Technologies and Progressive Developments in an Advancing Borderless Society", The Optoelectronic Industry and Technology Development Association (OITDA) November 2004

- JTEC Panel Report on Optoelectronics in Japan and the United States, Japanese Technology Evaluation Center (February 1996)

APPENDIX F INVESTOR STATUS

Area	Expectation of Private Investor	Reality in Optocap Limited	Implications for Investment
IP Position	Strong patent position or specialist know-how in start-up team that differentiates the company from competitors	No specific IP at inception and there is no funding in the grant for creation of an IP position via an R&D programme	Unless the team serendipitously creates some IP as a result of a client project, Optocap will fall at the first hurdle for an investor
Market opportunity	Rapidly growing, and hence high margin, target market	Telecom market, where Optocap's strengths lie, was in the doldrums when Optocap was established and is still depressed	Optocap needs to reposition itself, perhaps as a bio-chip package licensor, if it is to attract investor attention
Management team	Strong record of achievement, and hence network, by the key officers in the target market	CEO has not operated in the sectors that Optocap addresses	Would not be a deal killer if the CTO was the key strength of the team and the IP position was very strong (since investors would bring in extra team members) but this is not the case for Optocap
	CEO, CFO, CTO and (possibly) Business Development are all filled with strong candidates	CEO tries to cover all of these roles except for CTO (limited role anyway, due to lack of R&D focus)	
Exit Strategy	Management team is clear how investor value can be realised via IPO or trade sale	Some thoughts at inception that investors might buy into an equity portfolio from EDP projects	Without a clear vision on the level of value creation, private investors will never be won over
		Management team would probably prefer total ownership in their own hands without any specific intention to sell on	Investors look for a management team that will enrich both parties, not just get by as a company

Area	Description of Current Situation	Reaction of Potential Investors	Potential Improvements
Optocap Offering	Optoelectronic packaging prototyping and small volume production	• Optoelectronic packaging is a cottage industry that is very difficult to scale. • Small volume production will never make the returns looked for by investors.	Move into higher revenues via higher volumes. Manage transfers to lower cost countries to improve scaling.
Optocap Market	Skills mainly for telecom but with some view to MEMS and bio-chips in the future	• Optoelectronics, and particularly for the telecom market, is an area that has had its chance of investment and investors are very wary of going there again. • Investment in technology start-ups are being avoided, so linking to more speculative markets does not necessarily improve the attractiveness.	Continuing to pursue a mix of clients will give a solid base with some potential upside, but it will be difficult to excite investors no matter which market is chosen.
Business Model	Fees for service	• Service companies that rely on adding more clever people in order to grow are inherently unattractive as they are difficult to scale to make high returns.	Move into higher volume production where fixed assets can be worked harder
	Deferred payments and equity	• Investing in university technology is a long-term play that no longer interests the major investment companies. • Any future revenues would be heavily discounted by investors due to the high risks in realising the value from university spin-outs / licensing.	Create shorter-term revenue streams such as licensing to commercial customers

APPENDIX G GOVERNANCE TEST

The governance of Optocap Ltd was evaluated through extensive review of the financial, legal and operational procedure documents as well as interviews with the key Optocap and SE/SEEL staff members. The evaluation process examined the following functions

- **Operation of the Board**
  Including review of team skills, past experience, structure and any conflict of interest
- **Role of Advisory Board**
- **Staffing and Organisation of Optocap Ltd.**
  From the organisation structure, through the definition of roles to the skills and interaction of the team.
- **Management Procedures**
- **Financial Procedures.**
  The brief of the current evaluation does not extend to a full financial audit. However a number of observations can be made in this area
- **Reporting Procedures**
- **Company Operations**
- **Monitoring & Evaluation**
- **Risk Management**

The results of this evaluation and associated recommendations are summarised in the following table categorised against

- **Strategic Controls**
- **Financial Controls**
- **Operational Controls**
- **Monitoring & Reporting of performance**

Question	Assessment	Evidence	Recommendation
Adequate Strategic Controls in Place			
There is a business plan in place	**Compliant** Initial plans were not strong but the latest plans show better assessment of business performance and future commercial opportunities.	Obtained copy of Business Plans from March 2003, March 2004, August 2004	**Desirable** – Keep improvement in business plan with annual review to identify key business improvements.
There is a Memorandum of understanding and Articles of Association in place	**Compliant** Documents exist.	Obtained copies from OP manager.	**None**
There is an organisation chart	**Compliant** Document exists.	Obtained copy of latest organisation chart from CEO	**None**
There is a legal contract in place to secure funding	**Compliant** Document exists.	Obtained copy of Grant Contract letter , associated business plan	**None**
Staff / Board involved have appropriate experience	**Borderline Compliant** OP manager has relevant industrial experience. CEO has relevant commercial and management experience but does not have relevant technical or sector experience. Board has limited industrial credibility. The board do not have sufficient sales & marketing experience to drive OP to improved commercial revenue growth. Senior engineers are well	Discussions with Board members, CEO and OL staff.	**Desirable** – Board is improved with an industrialist entrepreneur from a related technical/market background. The addition of strong sales & marketing skills within the board is a key requirement.

	qualified for positions.		
Question	**Assessment**	**Evidence**	**Recommendation**
There are adequate delegated authority procedures in place	**Compliant** CEO is allowed to run OL without day-to-day interference whilst Board ensures economic objectives are considered and CEO has appropriate matching targets. Other staff do not perceive any interference from Board.	Discussions with CEO and OL staff.	**None**
There is a conflict of interest register at Optocap Limited	**Compliant** Register exists and shows external interests of the Directors. Register is shown to new employees.	Viewed register at OL, discussed with CEO	**Desirable** – CEO should revisit list of active clients at meetings of all employees (perhaps every six months) to remind them to consider changes in their own position
There are adequate procurement rules in place	**Compliant** Three quotes obtained for items in excess of £10k where multiple suppliers exist. Revenue items >£1k and capital items >£5k need Director approval.	Interview with CEO. Interview with SAGE operator who allocates purchase order numbers.	**None**

Question	Assessment	Evidence	Recommendation
Adequate Financial Controls in Place			
Adequate Segregation of Duties	**Borderline compliant** General sound processes with good written procedures if followed. However, found evidence of project managers signing invoices alone.	Interviews with CEO, management team and accounts administrator. Reviewed internal process documentation.	**Desirable** – check off company procedures against SE finance best-practice on budget handling and separation of duties. (SE best practice involves an Approver and a Budget Holder). This 2-way separation of financial duties, needs to be initiated.
There is a fixed asset register in place and it is adequately maintained	**Borderline Compliant** Register is located in several places: • SAGE system where dates and values are located • Excel spreadsheet where asset ID numbers are held • Paper documents where items bought in groups (e.g. from Nortel) are listed with their individual prices	Viewed and obtained copy of Excel-based register of assets at OL, and verified that new PC was marked with asset number and included in the register. Discussed SAGE and paper systems with CEO.	**Desirable** The Excel database should be updated with purchase date and price of all assets in order to make the asset list more easy to access in the absence of CEO
There is a qualified person responsible for maintaining the accounts	**Compliant** Accountant tidies up SAGE entries and gives advice to CEO monthly.	Discussions with SAGE operator and CEO (see also VAT below)	**None**

Question	Assessment	Evidence	Recommendation
The accounts are reviewed regularly and prepared in a timely manner	**Compliant** Accounts are reviewed at monthly Board meetings. Annual accounts to March 2004 were submitted within legal time limits. Accounts to March 2005 not yet submitted.	Copy of OL company accounts for Feb 03 to March 04 obtained from OP manager.	**None**
There are adequate systems and procedures in place for purchase ordering	**Compliant** Purchase Order (PO) system is well controlled by SAGE operator and she checks that correct authorisations have been obtained before sending PO to supplier. PO status log used to allocate PO numbers, to chase suppliers and to reconcile PO with delivery notes. Nominal codes used on PO to facilitate later entry into SAGE.	Viewed purchase order signed by Directors for $441k in PO paper file. Viewed PO log In Excel. Stepped through process with SAGE operator.	**Desirable –** invoices could be signed off by Project Managers before entry to SAGE in case issues have arisen of which SAGE operator is unaware
There are adequate systems and procedures in place to reconcile and prepare VAT claim	**Compliant** SAGE operator enters both input and output VAT, checked for accuracy by accountant. VAT returns are prepared by accountant.	Obtained copy of VAT return to 30/9/05, signed by accountant. Discussions with SAGE operator and CEO.	**None**

Question	Assessment	Evidence	Recommendation
There are adequate systems and procedures in place to monitor and account for revenue	**Borderline compliant** Jobs are normally small and invoicing is driven by issue of delivery notes. Project managers sign invoices. Project consumable items for commercial projects are assumed to cost as per quote issued to customer and no check is made to reconcile with actual costs (EDP consumables are monitored via SAGE codes). This could allow project managers to buy items for personal use without being invoiced to a particular client. Actual manpower costs on all projects are not monitored, so that EDP projects in particular could seriously over-run without management attention. CEO informs SAGE operator of BACS payments from customers, and accountant double checks all BACS entries in SAGE.	Discussion with SAGE operator. Viewed copies of invoices signed by project managers, held in SAGE operator paper file.	**Essential** – if OL enters into larger, longer-term contracts an automated invoice creation system will be needed. Invoices should still be approved by Project Managers. **Desirable** – specific project consumable purchases could be allocated against project codes in SAGE and customers re-charged for all items purchased **Desirable** – manpower effort could be monitored via weekly timesheets, and additional payments pursued where justifiable (including for EDP projects).

Question	Assessment	Evidence	Recommendation
Adequate procedures for monitoring and paying creditors and staff wages	**Borderline Compliant** Due to small number of supplier payments needed, SAGE operator keeps track of when payments should be made via PO log. Single person executes payments (cheques or BACS) though Director approval needed over stipulated amounts. Accountant operates payroll system during monthly visit.	Discussions with SAGE operator, CEO and Chairman.	**Essential –** all cheques should be signed by two OL employees / Directors **Essential** - second employee should participate in execution of BACS payments, taking part in preparation and checking of payments as a minimum.
Adequate procedures to monitor and ensure payment from debtors	**Compliant** Sales invoice log maintained in Excel by SAGE operator. SAGE also used by operator to flag late payments at the end of each month and second invoice issued. Revised schedule agreed with only poor payer, and customer has held to this schedule; SAGE operator has copy of schedule. Take up trade references for unknown customers (e.g. Portuguese company).	Interview with SAGE operator. Interview with CEO.	**Essential** – if contracts get larger, or for projects with significant inventory risk, more rigorous credit checks on local customers should also be performed; thresholds should be set for when these checks are to be made before entering into contracts.

Question	Assessment	Evidence	Recommendation
Adequate Operational Controls in Place			
There is a Business Continuity plan in place	**Compliant** Basic plan to use hot-desking facilities at Alba Centre in event of OL facility disaster. IT has daily back-ups. Rapid recovery of equipment and projects is not feasible.	Copy of Business Continuity Plan (section 9 of August 2004 Business Plan)	**None**
There are regular Board meetings	**Compliant** Board meetings are held approximately monthly.	Viewed Board meeting documents filed at OL, including signed Minutes, for Board meetings of 12/9/05, 31/10/05 and 5/12/05 as illustrations.	**None**
There is adequate insurance in place	**Borderline compliant** Directors and Officers Liability Insurance, and Employers' Liability Insurance, are in place for period of 11/8/05 to 10/8/06	Viewed certificates and insurance schedules from Chubb Insurance and St Paul Travelers Insurance at OL.	**Essential** – review whether £750k is sufficient to cover all fixed assets (excluding computers) given recent & planned purchases, and whether £100k is sufficient to cover business continuity in event of loss of facility.
There is a risk register in place	**Compliant** Last entry is November 2005.	Copy received from CEO.	**None**

Question	Assessment	Evidence	Recommendation
There are job descriptions of staff roles and responsibilities	**Non-compliant** CEO does not consider formal descriptions appropriate for a small and flexible company.	Discussion with CEO.	**Essential** In order to comply with SE requirements, the CEO should produce a basic job description for all staff. They can be written with flexible elements to avoid the rigid attitudes to tasks which the CEO understandably wants to avoid. These job descriptions would also assist with potential disciplinary action in the future.
There are adequate controls in place to ensure resources are appropriately allocated	**Non-compliant** No forward loading system is operative other than informal assessment by senior engineers.	Discussion with CEO.	**Essential** – simple forward loading system should be implemented for all staff, to identify potential overloads; this will become increasingly important as OL becomes busier.
There are adequate support functions in place (e.g. legal, human resources and ICT)	**Compliant** Initial legal support from SE's solicitors at SE rates, with modifications to business terms implemented by CEO. External HR consultant used to develop Company Handbook and employee contracts. IT consultant used to design OL network and is paid retainer to provide expert on-going support.	Discussion with CEO.	**Desirable** – CEO should consider wider skills training (beyond use of equipment) for all staff, though non-provision of such training is unfortunately standard practice for companies of this size.

Question	Assessment	Evidence	Recommendation
There is a Health & Safety procedure in place	**Compliant** General H&S policy document exists with supporting documents covering COSHH, injury recording, working with electricity, workstation layout, manual handling, emergency evacuation, laser safety. MSDS are held in separate file.	Viewed H&S files at OL and discussed with CEO. Viewed audit sheets at OL for COSHH compliance, workstation assessment and emergency evacuation procedure.	**Desirable** – periodic (perhaps annual) detailed external audit of H&S systems to ensure operating to latest legislation

Question	Assessment	Evidence	Recommendation
Adequate monitoring and reporting of performance			
There are targets in place and they are monitored	**Compliant** CEO and senior engineers have clear targets against which performance (and bonus) are evaluated annually, aligned with overall goals of OP. Monthly Board meetings also review progress on university and commercial projects. CEO has meeting with OP manager most weeks to discuss progress and issues.	Copy of targets set for CEO in late 2003. Copy of August 2005 performance review for CEO showing performance against targets for 2005, and forward targets for 2006. Electronic copies of Board meeting Agenda and supporting documents describing status of university and commercial projects.	**None**
Management accounts are reviewed monthly	**Compliant** Board meeting held (near-) monthly at which management accounts are presented.	Viewed Board meeting documents filed at OL, including signed Minutes, for Board meetings of 12/9/05, 31/10/05 and 5/12/05 as illustrations.	**None**
Cashflow is adequately monitored	**Compliant** Cashflow forecast is presented at Board meetings. Cash requirement from SE is managed so that bank balance target is £100k at end of quarter, and an internal process document exists to support this.	Electronic copy of financial projections to March 2006, dated October 27, 2005. Electronic copy of 250-021-00 Optocap funding guidance. Viewed Board meeting documents filed at OL.	**None**

Question	Assessment	Evidence	Recommendation
The Board regularly monitor the company's performance and financial position	**Compliant** Financial position is a standing item at monthly Board meetings	Viewed Board meeting documents filed at OL, including signed Minutes, for Board meetings of 12/9/05, 31/10/05 and 5/12/05 as illustrations.	**None**
Accounting records are kept up to date	**Compliant** SAGE operator runs very thorough systems. CEO checks SAGE entries before presenting management accounts to Board. Accountant provides monthly checks on accuracy of data.	Discussions with SAGE operator and CEO.	**None**
Staff have objective performance criteria that is subject to a performance review	**Non-compliant** Only CEO and 3 senior engineers have objective criteria and are reviewed (since they can earn bonus), all other staff are given informal feedback.	Copies of 2005 performance reviews for CEO and one senior engineer.	**Essential** – all staff should have annual performance appraisal where aspirations and training needs can be identified. Targets should be used for personal development purposes where bonus incentives are not available. **Desirable** - Quarterly reviews by line manager of own staff. Need only take an hour's chat if going well. Shouldn't be letting poor performance drift for a year before agreeing improvement actions..

APPENDIX H GATE 4 QUESTIONS

Question	Assessment	Evidence	Recommendation
1. Project Rationale and Objectives			
1.1.1 What is the rationale for the project? Does it remain valid?	To provide commercialisation route for Scottish academic and start-up projects and fill in market failure gap in optoelectronic supply chain. During the past 3 years there has been little change in the market failure with no competitor packaging facility in Scotland.	Original SE approval documents. Market research and interviews with commercial companies not related to Optocap. Interviews with clients (both academic and commercial).	**None**
1.1.2 Does the project have SMART objectives?	Not a formal part of the approval process but the project meets 4 out of 5 requirements	Original SE approval documents.	**Desirable** - Use SMART best practice in future projects. Particularly in the target definition and realisable check areas.
1.1.3 What is the project duration?	Originally 3 year project.	Final approval paper CEO Information Pack	**Desirable –** Project should continue until original grant funding is used (additional 2-3 years) in order to support EDP in pipeline and maximise potential for EDP support out to 2010 / 2011.

Question	Assessment	Evidence	Recommendation
1.1.4 What defines a successful project completion or exit?	Completion of 9 EDP projects and commercial sales targets met to demonstrate key role in Scottish Optoelectronic supply chain. Ideal exit strategy would be sale of Optocap Ltd to company, MBO or VC team.	Final Approval paper Business plans	**Desirable -** Assess feasible exit strategies at an earlier stage in the project.
2. Project Organisation			
2.1.1 Are key roles and responsibilities identified and clearly understood?	There is some debate over the dual roles of the Optocap chairman. As an SME there is the expected need for multi-functional skills and responsibilities of the small team. The team members appear to work exceptionally well together with good interpersonal operation and strong respect for the CEO.	Company organisation chart Interviews with CEO and management team	**Desirable** – Need roles and responsibilities of staff defined more formally - particularly as Optocap grows its commercial operations
2.1.2 Are lines of reporting as short and as clear as possible?	Reporting lines clear within the organisation as long as the operation of cross-manager job teams works.	Company organisation chart	**None**
2.1.3 Have individual responsibilities for decision – making been established and understood by everyone involved in the project?	The Board decision making process and agenda are clear and at a company operational level the processes are clear.	Company procedure documents Interviews with CEO and management team	**None**

Question	Assessment	Evidence	Recommendation
2.2.1 What individuals or groups are involved in, and affected by, the project (e.g. senior managers elsewhere in the Network or external customers or suppliers?)	Lead academics in Scottish Opto university research teams and directors/managers of new start ups in EDP projects. Increasingly project is impacting other commercial organisations in a positive way through the commercial sales process.	EDP project pipeline list. Interviews with university and company EDP and commercial clients.	**None**
2.2.2 Are there appropriate arrangements in place to manage the stakeholders' interests, including resolution of conflicting objectives and representation of end-users who may not be directly involved?	The main board and advisory boards have a strong representation of stakeholder interests. The main board are members of SEEL and the SOA trade association. SOA has 85 member organisations including companies, universities and research organisations.	Board Minutes Advisory Board presentation and membership list. Interviews with SOA, university and company EDP and commercial clients.	**None**
2.2.3 Is there (or should there be) a project board with a senior individual nominated to represent stakeholders' interests?	The current main and advisory board members provide strong representation of stakeholder interests. In particular Chris Gracie Chief Exec SOA represents the major user stakeholders.	Board Minutes Interview with Chris Gracie CE of SOA	**None**

Question	Assessment	Evidence	Recommendation
3. Project Management Process			
3.1.1 Is there a formal Project Plan, possibly broken down into stage plans?	No evidence of a formal project plan throughout the project. However, the project manager Mike Shiel did set up a Microsoft project plan when he was recruited to run the project.	SE Approval documents. Microsoft Project Plan Files on Optocap project initialisation and implementation. SE Project Lifecycle procedures PID 31/10/05	**Essential** – Implement appropriate project plan methodology as per new SE Project Lifecycle procedures for future projects. Need to ensure that relevant SE & SEEL staff are trained in new procedures.
3.1.2 Is a recognised project management methodology such as PRINCE2 being applied?	No	SE Approval documents. Microsoft Project Plan Files on Optocap project initialisation and implementation.	**As above**
3.1.3 What project documentation exists to support project implementation?	Business plan, Articles of Association, Grant Letter.	Business plan, Articles of Association, Grant Letter. MS Project files	**None**
3.1.4 Are there baseline schedules of milestones and activities?	Yes	MS Project files	**None –** As long as Mike Shiels' process is captured and repeated.
3.1.5 Are costs closely monitored and managed?	Yes.	Board papers Published Accounts	**None**
3.1.6 Does management data actually measure what it purports to measure?	The accounts, milestones, sales & market pipeline and risk register are reviewed at board meetings	Board Papers Risk Register CEO presentations	**None**

Question	Assessment	Evidence	Recommendation
3.1.7 Is there a documented change control procedure?	An adequate procedure is in place but quality manager acts more in a sign-off role than as an overall manager of the process.	Company process documents	**Desirable –** change control procedure is migrated towards ISO9000 model where quality manager also assesses the need for new documents.
3.2.1 Is there a risk register which is reviewed and updated regularly?	A comprehensive Risk Register exists for this project, categorising risks according the probability of their occurring, and the severity of impact which would result from their occurring. Chairman states that it is reviewed quarterly.	*OptoCap Risk Register*, Technology Team, SEEL, 24 October 2005	**None** This is an example of the project's best practice
3.2.2 Has responsibility for ownership and management of risks been allocated to individuals?	An agenda item on every board meeting. The risks are clearly brought to the attention of decision makers in the early board papers.	SEEL Board Paper of December 2002 (page 4 and App VII).	**None**
3.3.1 Do finance reports show expenditure / income to date, forecasts for the year and variances against budget?	Financial reports appear to be appropriate for a company of this size. Variances against latest CEO forecast were originally reported to Board but due to rapidly changing situation were taken out of report from CEO to Board.	Interview with CEO, who illustrated earlier variance report by showing filed Board meeting financial documents.	**Desirable –** Variances should be reported to board quarterly or 6-monthly. This longer time interval irons out the blips and could show underlying variance trends. The chairman should report variances from OP to SE.

Question	Assessment	Evidence	Recommendation
3.3.2 For large, complex projects is the financial reporting integrated with contract management, with contractors providing regular 'work in progress' statements?	No large complex projects	N/A	**N/A**
3.3.3 How are the reports integrated into SE's normal reporting cycle?	All board papers are held on file in SEEL. Risk Register updated Quarterly. The financials are posted to Susan McLellan at SEEL for oversight/upward reporting. The risk register and Control Checklist for Assets (annually) goes to John Fanning (SEEL Company sec). Project manager fills in Quarterly report for SEEL Board. Presentation to board made annually	Monthly Board meetings include P&L, Balance, Cashflow (+ projections), and output reports. Risk register. Discussion with project manager.	**None**
3.4.1 Have target benefits and outputs been clearly defined?	Our evaluation of the approval process identified benefit targets and outputs as a weakness. The Board meetings have improved the output targets in the light of market conditions.	SE Approval documents. Sample Board papers Precept Peer Review Document Interview with OP Project Manager 16/1/06	**Essential -** The new SE process should strengthen the analysis of and definition of the economic benefits and project target outputs.

Question	Assessment	Evidence	Recommendation
3.4.2 How are targets and benefits measured, reported and communicated?	Project and sales status reported at board meetings. Economic benefits not clearly reported or assessed. Project activities are captured quarterly on central KMIS system at SEEL.	CEO examples of signed output document	**Desirable** – Improve economic benefits assessment, probably through post project evaluation. Normal sales and project reporting OK.
3.4.3 Are forecast cost and benefits frequently reviewed?	Yes	Example board papers Published Accounts CEO presentations	**None**
3.4.4 How is the quality of project outputs being monitored and controlled, against the original specification?	The board meetings review the outputs and modify the company direction. No real evidence of strong reaction to low EDP performance by compensating in other areas (e.g. general marketing, increased commercial project focus or IP development).	Board meetings Output values	**Desirable** Stronger board response needed to increase commercial revenues in absence of EDP opportunities.
3.4.5 Is there a benefits management strategy with a clear allocation of responsibilities?	No evidence of an economics benefit management strategy	Board papers, start up documents CEO Info Pack	**Desirable** Need to develop a better approach to the benefits targets and monitoring approach
3.4.6 Are benefits being tracked effectively?	No evidence of this as a key issue.	Board papers	**As above**
3.4.7 For collaborative projects, do all parties understand and agree their responsibilities and arrangements for benefits	N/A no collaborative projects underway yet. However, imminent DTI funded project will change this.	Discussions with CEO	**None**

realisation?			

Question	Assessment	Evidence	Recommendation
3.5.1 Is there an effective resource planning process which identifies capabilities and possible constraints?	There is no personnel time booking or load forecasting system in place.	Interview with CEO.	**Desirable –** implementing time booking would enable real project profitability to be followed, and forecasting personnel loading will be essential as OL becomes busier.
3.5.2 What procedures exist to monitor and assess third party contractor procurement and performance?	Not applicable at present stage.	Interview with CEO.	**None**
4. Appraisal of Performance			
4.1.1 Are costs within budget and is actual expenditure in accordance with the planned schedule?	CEO has managed cost build-up to date to be lower compared to original plan so that draw from SE grant has been lower than anticipated at outset.	Amounts of grant actually provided to Optocap, obtained from CEO via email.	**None**
4.1.2 Have all approval conditions been complied with?	Optocap have focussed on EDP aims of project and organised themselves to meet the project operational conditions	SE Approval documents. Sample Board papers Precept Peer Review Document	**None**
4.1.3 Has external funding been delivered according to plan?	Funding has been delivered according to CEO request with agreement of Board (see 4.1.1)	Interview with CEO	**None**

Question	Assessment	Evidence	Recommendation
4.1.4 Are milestones being achieved?	The early stage implementation milestones were all achieved. However, the project operation EDP outputs are at least 1 year behind schedule.	Board papers and CEO presentations. Implementation MS project Files	**Desirable -** The implementation milestones have been met but the project outputs in terms of EDP and commercial targets need to be re-set in line with the evaluation market inputs and recommendations.
4.1.5 Is the project continuing to meet its objectives?	EDP objectives are proving to be more difficult to meet. The delays however are down to the academic partners and NOT Optocap efforts.	Board papers and CEO presentations.	**As above**
4.1.6 Is the original business case still valid?	The original business plans were too optimistic in terms of the times needed to set up EDP projects and the commercial market. There is also a move in the optoelectronic marketplace away from telecoms and into a broader range of applications.	Start up business plan Subsequent annual plan updates Financial accounts Board papers Market research Client interviews	**Essential** - New targets need to be set as per the more recent board meetings.
4.1.7 Do the original assumptions relating to achievement of project objectives still hold? Have any new conditions been identified during implementation?	The market for optoelectronics packaging has not grown as assumed. The CEO has been professional and reduced the spend rate and capital expenditure to reflect the longer sales cycle for EDPs.	Start up business plan Subsequent annual plan updates Financial accounts Board papers Market research Client interviews	**None**

Question	Assessment	Evidence	Recommendation
4.2 Review risk and issue management	Risks were correctly identified in risk register by December 2003. Main risks that have materialised are: - Target of 9 EDP not met in three years due to lack of suitable projects - Exit strategy may fail due to lack of interest by private investors Both of these risks are currently outstanding though: - EDP risk has been partly addressed by including start-ups as well as universities - CEO has begun to discuss exit via trade sale (though this might not be thought suitable by SE). - CEO is also interested in management taking over OL without VC investment	Interviews with CEO, EDP customers and VC companies.	**Essential –** more realistic targets for EDP should now be set, and assumption that VC capital can be raised should be abandoned in favour of concerted exploration of sale to trade buyer.
4.3.1 Where contracts have been entered into, are the respective roles and responsibilities fully understood and fulfilled to the contracted standard?	Projects have clear project leaders at OL. Performance feedback from customers is very good.	Interviews with CEO and staff. Interviews with customers for both EDP and commercial projects.	**None**

Question	Assessment	Evidence	Recommendation
4.3.2 Have any disputes arisen and, if so, what measures have been taken to resolve them?	Some issues with quality of initial builds by OL, but resolved satisfactorily according to customers. Late payment by one customer resolved by agreeing modified payment schedule (currently being adhered to by customer).	Interview with customers and CEO.	**Essential –** tighter checks by project managers on quality of initial builds **Essential** – if contracts get larger, or for projects with significant inventory risk, more rigorous credit checks on local customers should also be performed; thresholds should be set for when these checks are to be made before entering into contracts.
4.3.3 Has any underperformance been rectified?	Yes, customer complaints have been satisfactorily resolved.	Interviews with customers	**None**
4.4.1 Have all approval conditions been discharged?	Yes	Approval papers and implementation plans	**None**
4.4.2 Does the project remain state aid compliant?	Yes. There are still no intra-EU trade or competition distortions and the commercial pricing shows no unfair advantage. There is no competitor offering in Scotland.	See Appendix A5	**None**
4.4.3 Is there evidence to demonstrate that procurement rules have been observed?	Yes there are procurement documentation and rules for approving procurement. However financial controls could be improved	Optocap Process documents SE Certificate of Assurance Internal Control Checklist	**Desirable -** Need to review financial and procurement controls to ensure protection of company procurement.

Question	Assessment	Evidence	Recommendation
5.1.1 For the project going forward – what are the key lessons and changes affecting the next stage	The initialisation and start up processes were delivered reasonable well. The major challenges though are the need to move Optocap Ltd. towards a profitable operation with focus on; • Broadening EDP targets • Increasing commercial revenue levels • Improving marketing throughout UK and Europe • Broadening offering into new photonic applications in biotechnology, displays, lasers and MEMS This requires an improvement in the board structure, stronger targets and better monitoring, particularly in the economic benefits area. The above improvements are essential for SE to achieve a best value for money exit strategy over the next 2-3 years.	Due diligence approach in evaluating company performance and processes. OL Business Plans SG Market Research Client interviews Interviews with other optoelectronic operators in the UK	**Essential -** The following are the key changes needed to deliver the best future for Optocap Ltd and SE's desired exit from ownership • Modify board membership to add entrepreneurial drive to company direction • Improve sales & marketing process and skills in company to access broader market. • Continue the move to a wider EDP portfolio (not just academia). Set and meet revised targets. • Set significantly higher commercial revenue targets and organise company to deliver them WITHOUT missing revised EDP targets. .

Question	Assessment	Evidence	Recommendation
5.1.2 Have the recommendations from internal or external project reviews been implemented?	The previous internal SEEL audit revealed recommendations that have been implemented. The board has also changed direction and targets for the company, all of which have been implemented.	Board papers SE Certificate of Assurance Internal Control Checklist	**None**
5.1.3 What generic learning for the Network can be inferred from implementation of the project?	In general terms the Optocap project was professionally initialised and implemented. The only major disadvantage was that the early stages of the approvals process were not delivered in a speedy, efficient and accurate way. However, once past the Information Paper stage the process was delivered efficiently and effectively. The learning strengths include • Risk Register • Peer Review • Professional sector research • Benefits of good project planning	SE Rationale and Approval documents SOA research papers Risk Register Board papers Optocap Ltd internal process documents SEEL Internal audit	**Essential –** Retain the following best practices used in the project. • Risk management process • In depth professional research into sector demand • Use of professional planning techniques • Peer Review workshop • Exploration of alternative suppliers **Desirable** – Introduce the following improvements for future projects; • Operate a realistic check on market, turnover and demand levels • Develop a faster, simpler process for similar projects. • Establish better research, target setting and monitoring of economic benefits

Question	Assessment	Evidence	Recommendation
5.1.4 How are these lessons being shared with others who could benefit?			• Circualte this report to officials working in relevant policy and delivery areas. • Set-up workshop(s) to detail and capture best practice lessons.